# DOCUMENT RESUME

ED 051 998 SE 009 958

| | |
|---|---|
| AUTHOR | Bernstein, Edgar |
| TITLE | Independent Learning Project, Final Report 1967-1969. |
| INSTITUTION | Chicago Univ., Ill. |
| SPONS AGENCY | Illinois State Office of the Superintendent of Public Instruction, Springfield. Dept. of Program Planning for the Gifted. |
| PUB DATE | 69 |
| NOTE | 164p. |
| EDRS PRICE | EDRS Price MF-$0.65 HC-$6.58 |
| DESCRIPTORS | *Curriculum, Grade 9, *Independent Study, *Instruction, *Student Characteristics, *Student Participation, Talented Students |

ABSTRACT

During the 1967-69 ninth grade students at the University of Chicago Laboratory School had the opportunity to schedule various activities during an optional session when they participated in part of an independent learning project. Staff of the project included teachers of English, mathematics, science, and social studies, two librarians, a counselor, and a research associate. Seventy-three variables concerned with pupil background, indicators of study and conceptual skills, divergent thinking abilities, student self report characteristics (giving scores for sociability, diligence, individualism, and internal or external control), academic interest, use of optional time and indicators of pupil independence were analyzed. "Independence" is now seen as a mixture of habits of thought, ability, attitudes, and behavior characterizing a person willing and able to structure his own learning activities. For students initially independent, the program provided an opportunity for growth in self-reliant behavior; initially dependent students may not have benefited. Methods of differential treatment of these groups should be developed. Appendices include four papers on aspects of independent learning, copies of tests given students, and the means, standard deviations and intercorrelations for each variable studied. (AL)

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INDEPENDENT LEARNING PROJECT

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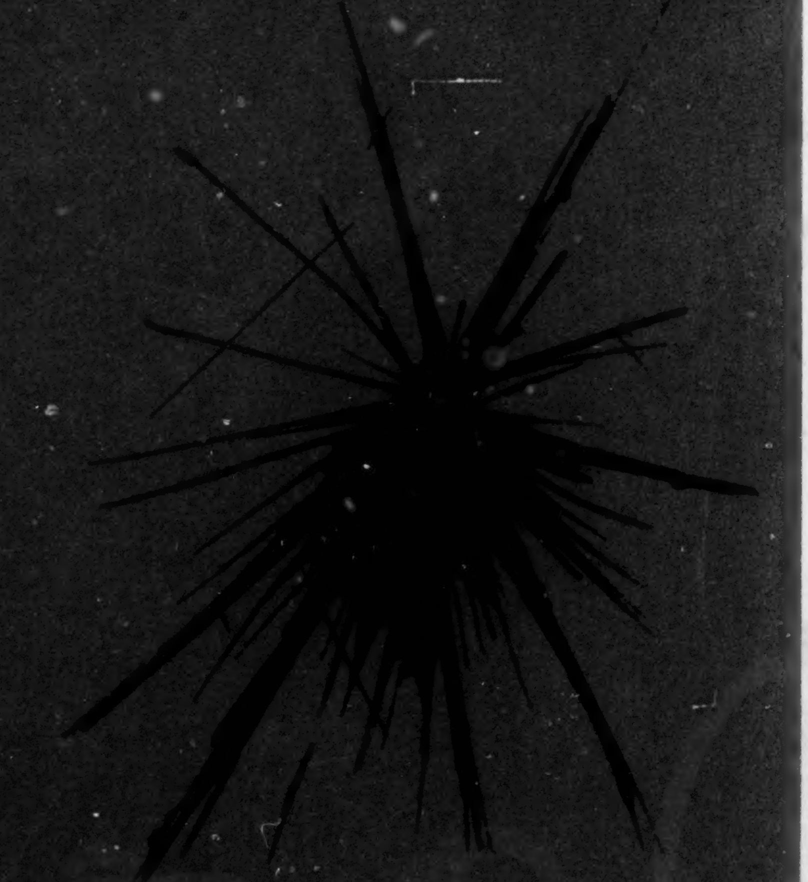
# FINAL REPORT 1967-1969

# Independent Learning Project

Edgar Bernstein and Philip Montag
Co-Directors

Report written by Edgar Bernstein



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The Laboratory Schools
The University of Chicago

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Report written by Edgar Bernstein

The Independent Learning Project has been
funded by the State of Illinois Plan for
Program Development for Gifted Children

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# PREFACE

The work of the Independent Learning Project for the 1967-69 biennium has been sustained by the efforts of many individuals. The project received significant administrative support and cooperation from Mr. Roald F. Campbell, Dean of the Graduate School of Education, Mr. Richard Johnson, Assistant Dean of the Graduate School of Education, and Mr. Francis V. Lloyd, Jr., Director of The Laboratory Schools. Through consultation and cooperation with our staff, faculty members of the University of Chicago have readily made important contributions.

Many of the accomplishments of the past two years have been the result of the creative work done by the curriculum and program staffs. These included:

## The Freshman Project Staff 1967-68

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Philip Montag
Thomas Newman
Jane Southworth

### Science

Jan Housinger
Judith Vertrees
Murray Hozinski

### Theater

Robert Keil

A great many of our colleagues in the Laboratory Schools not directly connected with the Independent Learning Project have again contributed ideas and criticisms to the benefit of the Project.

The continuing generous support from the State of Illinois Plan for Program Development for Gifted Children has been a major mainstay in our efforts. We are particularly indebted to Mr. Herbert Baker, Director, and Mr. Robert Hardy, Assistant Director, for their interest, wise counsel, and efforts on behalf of the Independent Learning Project.

We should also acknowledge our debt to Lynn Lanzetta, Administrative Assistant to the Directors, to Kathy Kamins and Judy Podmore who have shown creativity (and tolerance) in designing our graphics and to the Rev. Chauncey Black who has shown those same qualities in the printing of our materials.

And finally, it seems only proper to acknowledge the major contributions made by the students of the Laboratory Schools. For eight years they have used, criticized, and improved the program and materials and challenged and tolerated the staff of the Independent Learning Project. Just as we hope that they (and many other students) will benefit from what we have produced over the years, it is fair to say that we have become wiser because of them.

Edgar Bernstein and Philip Montag

# ABSTRACT

Institution: The University of Chicago
Chicago, Illinois

Edgar Bernstein and Philip Montag
Co-Directors

Title: The Independent Learning Project for Gifted Children

## PROBLEM:

In the 1967-69 biennium, the Independent Learning Project undertook final evaluation of selected aspects of the Freshman Project, while the main emphasis shifted to the problem of development of special curriculum materials designed for independent learning programs.

A. Research on the Freshman Project focused on refinement of the concept "independence" into various personality factors; analysis of student option choice patterns in relation to personality factors; and development of an operational measure of growth in independence.

B. Previous experience with the Freshman Project had shown the need for curriculum materials designed specifically to enhance independent learning behavior. Development and evaluation of trial curricula in English, Math, Science, Social Studies, Library and Theater which integrate subject matter and independent learning goals constituted a problem of major concern during this biennium.

## PROCEDURES:

A. The Freshman Project. An input-output model was designed to permit analysis of predictive weight of personality factors, ability, interest, skill-level, et al. for performance in independent learning in the option program as judged by measures of divergent thinking ability, subject matter achievement, student time usage, capacity for self-direction et al.

B. New curriculum units which incorporated independent learning goals were written by subject matter specialists in the Laboratory Schools. These materials were subjected to classroom testing and initial evaluation and revision were based on teacher observation and student reaction.

C. Workshops were held for educators from other Illinois schools, both to disseminate our concerns and findings in the field of independent learning and curriculum materials development and to seek new ideas and criticism for further effort and research.

## RESULTS:

A. The Freshman Project. Research results were encouraging. The operational measures of input variables were indeed predictive of performance

in independent learning situations (the option program). The findings also suggested directions for future research on personality factors and the need to modify independent learning programs in response to the findings of this research.

B. Results of classroom use of newly developed curricula suggested the viability of these materials to enhance independent learning in the subject matter areas. Need for further revision and improvement of these materials has been indicated by these initial trials.

RECOMMENDATIONS:

A. Develop, test and revise independent learning curriculum materials in English, Mathematics, Science, Social Studies, Theater, Music and Library. Special emphasis should be placed on the organization of these materials to promote sequential development of the subject matter goals and student growth in independence. Test these materials in the Laboratory Schools and in selected Illinois schools (including inner-city, suburban, other urban and rural settings).

B. Develop and test procedures for a single-subject, three grade level independent learning program -- the Student Ordered English Curriculum (SOEC).

C. Engage in empirical research on refinement of personality characteristics influencing independent learning. Specifically rigidity/flexibility measurements as these cognitive-intellective behaviors relate to independent learning. This will be done 1) with feedback from the Freshman Project data analysis and 2) from the curriculum materials development analysis.

D. Schedule a three week summer conference followed by one day follow-up workshops during the school year to inform Illinois educators, particularly those involved in the Gifted Program, about our work and to obtain their reactions, criticisms, and suggestions.

## DIGEST

INSTITUTION: The University of Chicago
Chicago, Illinois

TITLE: The Independent Learning Project for Gifted Children

During the 1967-69 biennium, the Independent Learning Project at The Laboratory Schools of the University of Chicago has continued to develop programs and curriculum materials which enhance student independent learning behaviors. Research efforts have resulted in more precise definition of independent learning characteristics and in preliminary analysis of the operation of these factors in various types of learning situations. Results, findings, and conclusions have been shared through workshop and publication activities.

It is the view of the Independent Learning Project staff that the ideas, procedures, materials, and results of this project can be applied to a wide range of school settings. As is the case with all educational practices, such application can be expected to require modifications in various school settings and populations. We are confident that this can be done without detriment to the effectiveness and validity of the project intentions and procedures.

# SECTION I

## STATEMENT OF THE PROBLEM

A. The Educational Requisites of Contemporary American Society and Independent Learning

B. Independent Learning and Gifted Child Education

## A. The Educational Requisites of Contemporary American Society

The problems of a mass technological society which values freedom and democracy are manifold. Loss of individual identity, an over-riding concern for economic and technological efficiency, a sense of powerlessness in political, social and economic decision-making -- all are reinforced by a wide education gulf separating decision-makers from citizenry. Education in the mass democratic society must function to narrow the gap between leaders and led by raising the education level of the latter so that they can bring effective participation and rational criticism to bear on significant social processes. Over-heavy dependence on leadership by a relatively small educational elite represents more than a contradiction of democratic values. It makes society vulnerable to individual human limitations and errors on major social, political and economic questions affecting the entire society. The corrective can come only from creation of a wide base of informed, critical, participating citizenry -- a task that falls substantially to the schools.

It has been the contention of the Independent Learning Project staff over the past nine years of operation at the University of Chicago Laboratory Schools that the requisites of both the mass democratic society and the individual in that society represent conscious goals of independent learning programs and materials. Explicit efforts have been made to design learning environments and materials which are consistent with and impart the highest cultural values, reinforce social participation and cooperation, encourage development of individual talents and critical and creative capabilities, and offer choice and decision making in the learning process.* So-called "traditional" teachers also claim service to these goals, perhaps with much validity. The crucial characteristic of independent learning that may differentiate it from other learning modes has to do with maximizing active student participation in the learning process as a means to achieve these ends. The traditional educational approach of "telling about" political and social participation, personal responsibility and decision-making represents a necessary but incomplete resolution of the educative function; actual experience with honest versions of these activities should comprise a part of the education of the young. And this experience should take place within a learning framework that encourages thoughtful student action under the aegis of concerned, cooperating, unthreatened adults.

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*For a generalized model and discussion of independent learning and the school environment, see Bernstein, Edgar and Philip Montag, "Independent Learning," Indiana Social Studies Quarterly, Vol. XXI, no. 1, Spring, 1968. (Appendix A of this report).

## The Common Culture

Education is expected to transmit the Common Culture. But attempts to define that commonality are difficult in this historically pluralistic society. At the general level such values as individual freedom and choice, equality, responsible and rational political behavior, and concern for the rights and dignity of one's fellow man are commonly held values to be served by specific educational practices. The social institutions which uphold and serve these values must also be given attention. But teaching cultural commonality in this populous urban society is a different task than that faced by the smaller traditional societies. Below the general value level it is difficult to identify commonality. Search for it is likely to lead to the question: whose common culture? The Common Culture to be taught in schools is surely not only white and Protestant, with a western European flavoring. To cast this or any sub-culture in the role of The Common Culture consists of cultural tyranny. One must accept (and teach for) the cultural pluralism that exists in this society.

It must be assumed that effective transmission of culture will result in more than knowing about society's highest values and institutions; the ability and disposition to act in concert with, and because of them must also be imparted. "Learning about" the culture, therefore, must entail more than absorbing cultural information and description; it must include experience with active application thereof.

## Education for Change

Educational systems are more than transmitters of past traditional wisdom, ideals and institutions. They are instruments for preparing the young to deal with the present and future in a way that will preserve and make use of the best of the past. Even when deemed undesirable, the response to change cannot always be rejection. "Education for change" is preparation for dealing effectively with unknowns in a way which, as much as possible, uses and remains true to prior cultural boundaries.

Transmitting the culture may accomplish part of the task of providing "education for change." Studying biographies and historical events which represent positive and valued examples of change could provide models for the young to emulate. Ideally, this would include a wide range of examples in American history, incorporating instances which have not necessarily held a favored position in traditional American mythology. And the pantheon of

American heroes might come to look a little different. However, if teaching this or any content takes on the quality of indoctrination, what happens to the development of critical facilities in the young? Students must confront a variety of examples of social change and learn to examine, compare and differentiate them. Such critical analysis, in turn, will be served by more generalized understanding of the nature of social change which makes it clear that change results from more specifiable and controllable factors than fate, the furies, or the nefarious machinations of a few evil men (no matter how fascinating their biographies may be). If the young are to learn that change is a given in the human condition and that it is not totally beyond human understanding and control, they must learn to comprehend the various processes by which it may come about.

"Education for change" entails more than imparting information and concepts about social change. Such education might also encourage the young to feel a personal responsibility for extending and applying data and ideas in ways that are meaningful to them by giving students opportunities to participate in formulating general understandings from concrete data. New social theories will not result, of course. But recognition that ideas are useful man-made products, that there is need and use for continuing social analysis, and that individually students may have something to contribute to the arena of knowledge -- these might result. Theories of social change, like all intellectual constructs, are impermanent structures to be used when and where they apply to provide a foundation for extending knowledge and understanding in the future. The young should come to believe in the possibility of extending that knowledge; by being invited to engage in intellectual choice and decision-making, that possibility is made real to them.

For the teacher to carry the role of possessor and purveyor of all ideas denies to the student the possibility of intellectual choice and innovative thought. And for the teacher to present only historical facts and biographies without offering opportunities for broader interpretations and conceptualizations allows students to remain ignorant of these intellectual possibilities. It portrays, instead, the view that human knowledge is an atomized accretion of information for which no sense or organization can be provided (except, perhaps, the historian's time and the geographer's space). One is justified in wondering whether or not this kind of education helps to explain the confusion that exists during political campaigns with reference to "the real issues" behind the welter of facts in candidates' speeches. How much easier to give up and settle for judgments relating to the attractiveness and charismatic qualities of the candidates. After all, to make order out of all those facts is too much for "ordinary" people anyway. Leave it to the experts, a practice sanctioned and well-established by twelve years of schooling.

## Socialization and Choice

Traditionally, young people have been taught to value freedom and latitude of occupational choice. Today's society represents a complex world for the young to enter, one in which choices are more numerous, difficult and individual than in the past. Past and present, the young have tended to resolve the question of occupational choice in favor of their parents' activities. If that was considered satisfactory in the past, then the present situation is of little concern. Unless it is true that young people today are less secure with automatically adopting their parents' way of life because the world has changed fromyesteryear and truly offers a a much larger choice and more freedom economically to exercise that choice. Is the young adult's consequent frustration the result of too much choice, or does it derive from perception of more choice than his parents recognize? If it is a problem of too much choice, the task for the surrogate parent (the school) is clear. It must allow students to experience choice-making increasingly over twelve years of schooling so that they become more and more expert with this role and learn to exercise it effectively. Surely one cannot argue that the way to train the young for adulthood in a complex, confusing world is to keep them passive and obedient, never developing a repertoire of choice and decision-making experience on which to base future action. The school must prepare the young for future choice- making roles as their age and development dictate. Not too much too soon. Nor too little too late! The degree of insecurity and frustration felt by the young upon arrival at the choices of adulthood is likely to be directly proportional to their prior successful experience with choice-making.

But to make youngsters more effectively adult at earlier ages raises problems in a society which continues to expect a long infancy from them. Such youngsters do not neatly fit the dependent roles traditionally reserved for them. This is a problem for parents and teachers who, also by tradition, need to be needed. It becomes the students' problem when adults project their needs and expectations on the youngsters. It may be true that some youngsters are alarmed and traumatized by the spectacle of choice and resolve this by going into their fathers' businesses and professions. It is clear that others make that same decision because they cannot comfortably resolve the conflict between their own views and their parents' expectations. To make the young more effective at decision- making earlier than has been traditional may be disconcerting to adults. That is, perhaps, part of the price of effectively socializing the young for the future role they must play -- for themselves and society.

This point is particularly crucial for schoolmen appraising educational practices. Acting as surrogate parents, educators sometimes tend to confuse personal values and needs with broad educational objectives. Assumptions about young peoples' need for "structure" effectively portray this tendency. Administrators and teachers analyze the behavior of problem students and comfortably conclude that such students all suffer from parental indifference and, therefore, lack of sufficient structure and guidance in their lives, resulting in alienation from society. This is undoubtedly true for some. But it is clear that other problem students suffer from, and become alienated by, too much structure and guidance at home and at school. It is assumed that all kinds of youthful antisocial behavior represent a cry from the young for structure from the adult community. Opposition to school rules may sometimes be a call for help. It may also be an outcry against authoritarian overload imposed on the assumption that all youngsters need structure because some youngsters have truly lacked sufficient guidance. Schools might also give attention to the kind of student who has made a total, successful, and uncritical adjustment to a heavily structured system throughout his learning career. One might validly have concern for his ability as an adult to make and act on critical personal choices and political decisions when there is no one else to provide guidance and impose solutions for him.

Many educators justify students' need for much structure with the argument that the young need a consistent model of adult society against which their strivings for young adulthood may rebound. But students' need for consistent structure in this model is not synonomous with the need for stringent, thorough-going structure. Consistency is attainable in a flexible and open-ended system as well as an authoritarian one! Nor does students' need for an adult model against which to react require that model to generate antagonism against those who maintain the structure. Adolescents will no doubt react to whatever structure is created, but antipathy should be minimized by creating a structure which students will respect because it conforms to and honestly serves the values of society. Some young people oppose adult structures not because they are really crying for love and attention (i. e., more structure), but because they see those structures contradicting the highest of society's ideals. There must be consistency not only within the structure; it must be found as well between the structure and the highest of socially held values. Educators evaluating the efficacy of a given set of school practices must carefully differentiate their own needs from the proper needs of the young in preparation for adulthood. Teachers and administrators may themselves require much structure both personally and to justify their professional roles -- these are valid human considerations not to be lightly ignored. But they must be secondary to the needs of the society and to the educational practices appropriate to those needs.

## Conclusion

The proper function of education in this society is to provide for both cultural continuity and change. Since the world of tomorrow will surely be different from the world of yesterday, the task of education cannot be to prepare the young for the past. Rather the goal is to educate the young so that they can retain the best of the past and create new cultural forms that are complementary to and consistent with the old. The ideal goal of education in this society is represented neither by the wise man who cannot act on his wisdom nor the man of action unmoderated by wisdom. Individual and societal requirements entail effective thought and action.

## B. Independent Learning and Gifted Child Education

Independent learners, as defined by the staff of the Independent Learning Project,[1] fit the value orientation, and provide the requisite bases of, any society which styles itself free and democratic. Interest in the methods and materials that foster independent learning is reinforced by arguments that more effective and long-lived learning results therefrom.[2] Increased use of such terms as discovery learning,[3] inductive learning,[4] and autonomous inquiry,[5] denotes a growing conviction as to the efficacy of students' active and creative intellectual involvement in the learning process. Educational innovation and improvement are sought in the service of two traditional goals -- effective societal participation and effective learning. These educational goals, both personal and social, assume that the young will maintain the active inquiring minds nurtured in their school years. The work of this project has been directed to the generation of ways and means to explicitly foster these qualities. The project has long subscribed to Gage's view that the young, to achieve these ends, "should have supervised experience in learning independently -- experience in which the instructor helps the student learn how to formulate problems, find answers, and evaluate his progress himself."[6]

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[1] Bernstein, Edgar and Montag, Philip, "Independent Learning," Indiana Social Studies Quarterly, Vol. 21, no. 1 (Ball State University, Muncie, 1968). See Appendix A.

[2] Bruner, Jerome, On Knowing: Essays for the Left Hand (Harvard University Press, Cambridge, 1966).
Bruner, Jerome, The Process of Education (Harvard University Press, Cambridge, 1960).
Wertheimer, Max, Productive Thinking, (Harper, New York, 1945).

[3] Brown, Richard. A speech delivered toa workshop sponsored by The Amherst Project and the Laboratory Schools of the University of Chicago March, 1966.

[4] Fenton, Edwin. Teaching the New Social Studies (Holt, Rhinehart, and Winston, New York, 1966).

[5] Suchman, J. Richard. The Elementary School Training Program in Scientific Inquiry (University of Illinois Press, Urbana, 1962).

[6] Gage, N. L., (ed.), Handbook of Research on Teaching (Rand McNally and Company, Chicago, 1963), p. 1145.

The focus on independent learning seems to have particular significance for the education of gifted children. Smith's study,[7] for example, suggests that independence is a significant differentiating characteristic of gifted students, and Lucito's work[8] indicates that high intelligence can contribute to students' independence, a point that finds support in data reported by this project.[9] Yet it has been frequently noted over the life of this project that high intelligence is neither synonymous with, nor the only prerequisite of, independent learning behavior. Individual high IQ youngsters can exhibit relatively dependent behavior, suggesting personality characteristics are a significant determinant of independence.

Furthermore, Torrance's research[10] suggests that, above the IQ level of 120, academic excellence in gifted children must be explained partially in terms of creativity rather than by higher levels of intelligence scores. Creativity is accepted as a significant characteristic of the independent learner[11] whose exhibition of this quality in the intellectual sphere approximates the "intellectual passion" discussed by Polanyi.[12] Data gathered by this project during the current 1967-69 biennium, using creativity instruments adapted from Getzels and Jackson,[13] indicate that pupil creativity plays an important role in teacher assessments of independence. Creativity, evidently, is positively valued and rewarded in the independent learning program constructed by this project.[14] The significant gain in creativity scores found for students in this program provides encouraging data with reference to the experimental need posited by Gallagher as significant to education for gifted children, i. e., the need for evaluating the effectiveness of programs in stimulating creative thinking ability.[15] The possible efficacy of independent learning programs and materials for fostering creativity may be of importance to the State's Gifted Child Program with respect to one of its prime focuses, that of talent retrieval.[16]

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[7] Smith, D. C. Personal and Social Adjustment of Gifted Adolescents. Council for Exceptional Children, Research Monograph, No. 4., Washington, 1962.

[8] Lucito, L. J., "Independence-Conformity Behavior as a Function of Intellect: Bright and Dull Children," Exceptional Children, (1964), pp. 5-13.

[9] See Final Report to the State of Illinois for 1963-65.

[10] Quoted in James J. Gallagher, Research Summary on Gifted Child Education. (State of Illinois, Department of Program Development for Gifted Children, Springfield, 1966), p. 49.

[11] Bernstein and Montag, op. cit.

[12] Polanyi, Michael, Personal Knowledge: Toward a Post-Critical Philosophy, (University of Chicago Press, Chicago, 1958).

[13] Getzels, Jacob W. and Jackson, Philip W., Creativity and Intelligence, (Wiley and Sons, New York, 1962).

In conclusion, the educational concerns and goals of the Independent Learning Project significantly overlap those of the Gifted Children Program of the State of Illinois. Continued development, testing, and dissemination of independent learning programs and curriculum materials into Illinois schools has, therefore, been in direct service to this program.

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[14] See Section III, B. of this report.

[15] Gallagher, op. cit., p. 58.

[16] Cf. Betty Butler and others in the Illinois Journal of Education, October 1968, Ray Page (editor). (Superintendent of Public Instruction, Springfield, Illinois).

# SECTION II

# THE INDEPENDENT LEARNING PROJECT

A. Structure of the Project
    1. Project Activities
    2. Interrelation of Project Activities
    3. Structural-Functional Analysis of Project Activities

B. Curriculum Materials Development

C. Dissemination of Project Information

## A. Structure of the Project

### 1. Project Activities

The goal of this project has been expansion of Gifted Child Education in Illinois schools through dissemination of independent learning programs, ideas and materials. To that end, this project has engaged in four general interrelated categories of activities: programs development, curriculum materials development, research and workshops. Discussion of these activities follows.

The development and testing of independent learning programs comprised the focus of this project for the first six of its eight years of existence. These programs were concentrated mainly on scheduling and grouping procedures and teacher methologies for a multi-subject, single grade level (ninth) program called "The Freshman Project." The Freshman Project represented attempts to manipulate the structure of the learning environment in order to enhance independent learning behavior. Quarterly and final reports from previous years and the research section of this report indicate the encouraging results obtained in this program. Current interests represent a shift in program focus to a single subject, multi-grade English program, a departure from past programs in terms of both type and amount of structure (though there is evident continuity from earlier programs). This shift in emphasis represents both a satisfaction that the effectiveness of independent learning programs like The Freshman Project has been demonstrated over the years and a desire to investigate a qualitatively different program structure.

During the years of focus on the ninth grade program, concerns for curriculum materials availability were consistently raised. The program itself was seen as no more than a mechanism for enhancing independent learning. Its qualitative character was determined to a great extent by teacher methodologies and curriculum materials. Methods were given attention, but lack of available commercial curriculum materials appropriate to independent learning acted as a constraint on innovative teacher methods and therefore on the program as a whole. To a limited extent during these years teachers began to create materials that reinforced the program structure and complemented teacher methodologies. But such ad hoc provision for materials development was inadequate to the needs of the program and during the 1967-69 biennium the project has given major attention to the development of new curricula which foster independence in learning.

Research activities have been focused over the years on attempts to evaluate the effectiveness of The Freshman Project. Research efforts have produced data analyses of student "option time" attendance and a variety of operational measures for various characteristics and behaviors thought to be associated with independent learning. It is through this research data that the project has been able to refine procedures for independent learning programs and to gain greater precision and understanding about independent learning. Also, research activities to evaluate the effectiveness of curriculum materials for independent learning goals will become increasingly important as this project gives increasing attention to these activities.

Finally, workshops stand as one logical and clearly effective means for meeting the goal of the Gifted Child program -- dissemination of experimental findings to expand gifted education. The evident value of past workshops, during both summers and school years, has encouraged the staff to continue using this mechanism as an effective way to share programs and materials, and to obtain valuable new ideas on these matters as well.

## 2. Interrelation of Project Activities

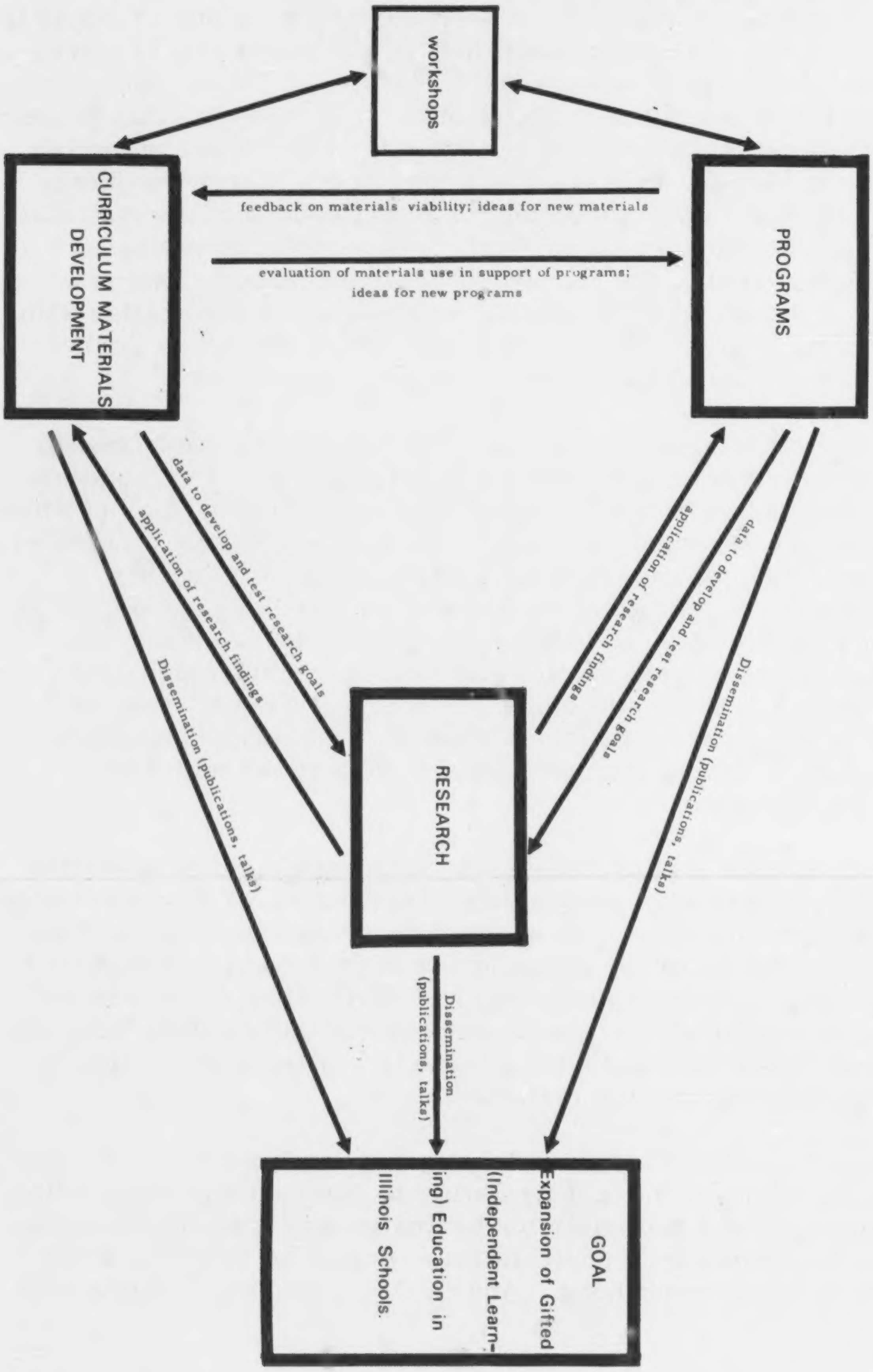
While programs, curriculum materials research and workshops are seen as separate structures useful to the work of this project, a significant overlap and interrelationship exists among them. Thus, programs generate the need and provide a place for testing curriculum materials. It was noted above that, in the history of this project, programs generated changes in teacher methods which generated new curriculum materials. It is widely accepted that attempts to institute educational innovations through the imposition of a program structure generally meet with much resistance. It is, therefore, interesting to conjecture on the counter-possibility (as this project staff has done) that attractive and effective curriculum materials may lead to changes in teacher methods which in turn encourage program receptivity. Assuming the effectiveness of the materials which, by their format, require changes in teaching methods, teachers may find in the security of their classrooms that new methods are both viable and valid. Subsequent confrontation with program structures related to the curriculum materials goals could then be viewed as palatable and even desirable.

In one other respect there is a crucial interrelation between programs and curriculum materials development. Programs do have a curriculum materials dimension (as with programs in which materials are expected to be generated by the program structure). And curriculum materials development, unless it is a very haphazard affair, has some programmatic basis provided by such things as sequence, a developmental view of the sequence, the format of the materials and the prescribed teacher roles accompanying the materials. Thus, while one can honestly discuss these two activities separately, the terms program and curriculum materials would seem to denote major emphases rather than mutually exclusive entities.

As indicated earlier, research comprises a set of activities naturally and logically interrelated to the activities discussed above. Research findings expand theoretical understanding of independent learners; these understandings derive in part from data supplied by independent learning programs and curriculum materials use. In turn, the research results make possible increasingly accurate judgments about the requisites of effective independent learning programs and curriculum materials.

Workshops find their relationship to programs and curriculum materials development in their ability to confront educators with new programs and materials for evaluation and training purposes. In turn, programs and curricula may receive an infusion of new ideas from these workshops. And finally, programs, curriculum materials development research and workshops, separately and in combination, affect expansion of the educational enterprise, posited as the end goal of this project's efforts.

A graphic summary of the ideas discussed above as they provide the rationale for this project's activities follows:


workshops
CURRICULUM MATERIALS DEVELOPMENT
PROGRAMS
feedback on materials viability; ideas for new materials
evaluation of materials use in support of programs; ideas for new programs
data to develop and test research goals
application of research findings
Dissemination (publications, talks)
application of research findings
data to develop and test research goals
Dissemination (publications, talks)
RESEARCH
Dissemination (publications, talks)
GOAL
Expansion of Gifted (Independent Learning) Education in Illinois Schools.

3. Structural-Functional Analysis of Project Work

In addition to the activities identified above (programs, curriculum materials development, research and workshops), it is possible to describe four functional categories which are applicable to each of these activities. They are represented by the following steps which follow a developmental sequence:

Step 1. Development - dealing with research, analysis and creation of programs, curriculum materials, teaching staff, operational measures and theories.

Step 2. Testing and Evaluation - dealing with analysis and appraisal of the strengths, inadequacies and needs of programs, materials, training activities, operational measures and theories.

Step 3. Revision - dealing with modification, expansion and deletion of parts of programs, materials, training activities, operational measures and theories resulting from testing and evaluation.

Step 4. Dissemination - dealing with distribution for public use of the information, ideas, operational measures, theories, program procedures, results of evaluation and testing, and curriculum materials, all of which may result from the previous three steps.

These steps form the sequential bases of project work in these areas. The graphic representation that follows provides a structural-functional summary of these activities.

| STRUCTURES | FUNCTIONS | | | |
|---|---|---|---|---|
| | Development | Evaluation and Testing | Revision | Dissemination |
| CURRICULUM MATERIALS DEVELOPMENT | 1<br>develop first versions of materials | 2<br>evaluate and analyze effect of materials for IL goals with varied school populations:<br>A. Lab School<br>B. Other Illinois Schools | 3<br>modify, expand, delete as dictated by evaluation activities<br>A. Lab School<br>B. Other Illinois schools | 4<br>distribute materials for public use |
| PROGRAMS | 5<br>develop procedures (schedules, grouping, methodologies) | 6<br>evaluate procedures for IL goals with varied school populations:<br>A. Lab School<br>B. Other Illinois schools | 7<br>modify, expand, delete as dictated by evaluation activities:<br>A. Lab School<br>B. Other Illinois schools | 8<br>distribute procedures, ideas and information for public use |
| RESEARCH | 9<br>initial development of experimental design (hypotheses, operational measures, and procedures) | 10<br>evaluate and analyze research findings | 11<br>modify hypotheses and operational measures as dictated by evaluation activities | 12<br>distribute research findings and operational measures for public use |
| WORKSHOPS | 13<br>A. teacher training, development of abilities to do and create what is needed for IL programs<br>B. develop new IL materials and procedures for programs (in workshops) | 14<br>A. continuing contacts with teachers to evaluate effect of teacher training<br>B. evaluate developed IL materials and programs (produced by both IL staff and workshops) | 15<br>A. continuing contacts with teachers to revise teacher training<br>B. revise developed material and programs (produced by both IL staff and workshops) | 16<br>distribute materials, information, ideas, procedures, findings, and operational measures for public use |

## B. Curriculum Materials Development

Curriculum writing activities have been undertaken in the areas of English, Mathematics, Science, Social Studies, Theater, and Library, engaging both individual authors and writing teams. In general, the work represents efforts to build independent learning goals into the objectives of the curriculum materials. This has become a major work focus, especially since June 1968.

Historically, there has been general acceptance of the view that the structure of each subject area determines the degree and kind of independence one can offer to students. Thus mathematics, with its skill orientation and concern for sequential relation of the parts of the curriculum, tends to find unattractive what has been termed "physical independence" which is "characterized by the absence of a teacher or some sort of classroom constraint."[17] Premium is placed, instead, on the student "using his own resources to deal with the material in his own way. He is searching for a discovery, an understanding, an explanation, an answer or a solution, using the full capability of his own intellect both in the process itself and in the evaluation of the results."[18] One is tempted to use the term "intellectual independence" for this focus. The ninth grade Algebra materials[19] currently being developed by these authors and their colleagues clearly reflect this concern. On the other hand, the authors of an English unit, Literary Man: Writer and Reader, which was developed to deal with critical reading and creative writing skills, offer a different route to independent learning. They expect the unit to change the role of the teacher. "No longer can he select material, dictate standards of taste or tell students how to do things. No longer can he establish a neat order of questions to ask, answers to be given, ideas to be considered."[20] Instead, the teacher using the unit creates an environment in which the student himself determines many of his activities. The sequence of learning goals is considered irrelevant, though the broad goals of the unit are clearly set and expected to be achieved. Ultimately, the teacher must seek a "delicate balance between structure and flexibility."[21] This English Unit offers middle school and early high school students opportunities for structuring their own activities within pre-set goal boundaries.

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[17] Moulton, Paul and Thompson, Marilyn. Independent Learning in Mathematics, an unpublished position paper, 1969. See Appendix B.

[18] Ibid.

[19] Thompson, Marilyn. Booklet 1 - Tables and Graphs, ILP, 1968 and Moulton, Paul. Booklet 6 - Systems of Equations, ILP, 1969.

[20] Feiman, Sharon; Friedman, Darlene and McCampbell, James. Literary Man: Writer and Reader, ILP, 1968.

Somewhere between the Algebra materials and Literary Man falls the approach taken in the production of ninth and tenth grade Social Studies materials.[22] Termed "guided inquiry," the format used in these materials accepts the sequential organization and problem-solving approach associated with Mathematics, and yet allows for students' "physical independence" -- the opportunities found in the English unit for students to structure their own activities within the pre-set boundaries of the problems. Ideally, experience with "guided inquiry" materials over time should prepare students finally to structure their own problems (a goal assumed to be shared with other subject areas).

Another format used in independent learning curriculum materials is represented by the Atomic Theory[23] unit in Science and the Scenery Design[24] unit in Theater. Both sets of materials are broadly organized into two parts: a first section which provides the information, skills and concepts basic to the unit, and a second "independent project" section in which students apply the learnings from the first section to a project of their own choosing in the area of unit concern. These units are interrelated, and all of them point to a final independent project inclusive of the learning gained through the separate units. Thus, structured learning is regularly interspersed with student-chosen and student-directed applications of that learning. It may be no accident that Science and Theater, areas with goals involving active physical application of learning, have both chosen to follow this format.[25]

A set of booklets entitled Library Tools[26] provides a final and initially surprising format for independent learning curriculum materials. The booklets, each dealing with a separate library skill, are constructed through the use of Skinnerian programming. Yet these highly structured materials can be seen as supportative of independent learning programs through the dimension of self-analysis and self-evaluation. Students choose to use these materials on their own library time because of their perceived need for them. They choose to take a self-evaluation library skills test which will direct them to the booklets they need to improve their library use. Thus, action based on self-evaluation comprises the independent learning focus of these materials. This structured approach may be the degree of learning independence appropriate to library work.

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[21] Ibid.

[22] For example, Cohen, James, Poverty and Economic Underdevelopment, ILP, 1969.

[23] Housinger, Jan and Vertrees, Judith, Atomic Theory, ILP, 1968.

[24] Keil, Robert, Scenery Design, ILP, 1969.

[25] For further articulation of these ideas see Housinger, Jan, Independent Learning in Science, and Keil, Robert, Theater, The Arts and Independent Learning, unpublished papers, ILP, 1969, Appendices C & D.

[26] Goldsmith, Stephanie, Library Tools, ILP, 1968.

From the above discussion of selected curriculum materials developed thus far by this project, it is clear that varying formats may be seen as appropriate to independent learning. Furthermore, the variations seem to reflect bona fide differences among the structures of the different subject areas. Differences in design stem also from the grade level for which the materials are designed and/or the amount of students' prior experience with learning independently.

The project staff has evolved a general model of curriculum development for "teacher-curriculum developers." The steps in the model are:

1. Teacher-developers do research into a given content area (using university consultants as sources of information regarding both important conceptual and content foci and significant literature in their fields.)

2. This research forms the basis for initial construction of materials which are tried out in classroom use in this institution.

3. The teacher-developers discuss results of first materials use with students and suggest modifications and amplifications of the materials and methodology.

4. The materials reformulations are developed (and referred to university specialists as needed for reactions and further suggestions as to both interpretation and scholarly accuracy.) The materials are then set down in refined "first approximation" form, ready to be retested in classroom use. A Teacher's Guide is developed to accompany these materials.

5. The refined materials are then tested in public school classrooms, from which final revisions come.

This model of curriculum materials development offers the advantages of making use of both teachers' experience and expertise in the secondary school classroom, and the academician's experience and scholarly training in his specialized area. The merging of both should produce materials which are viable for secondary school use and which represent responsible up-to-date scholarship. By this approach, the Independent Learning Project attempts to avoid some of the pitfalls of curriculum development that have characterized many fields. Kline's critical comments on the overbearing role played by university specialists at the expense of pedagogical considerations in the development of new mathematics curriculum comes to mind.[27] This model engenders a reasonable balance between pedagogy and scholarship, and is the procedural basis for the project's various curriculum endeavors. The specific sequence of activities expected of each curriculum development project is as follows:

1. Development and testing of new curriculum materials in Laboratory School classes.

2. Revisions of new curriculum materials based on first use and consultation; construction of appropriate pre- and post-tests.

3. Testing revised materials in Laboratory Schools and other Illinois schools; evaluation of results through pre- and post-testing.

4. Final revisions of materials based on results of use and re-use.

5. Dissemination of materials.

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[27] Kline, Morris, "Intellectuals and the Schools: A Case History," Harvard Educational Review, XXXIV, No. 4 (Fall, 1966), pp. 505-11.

## C. Dissemination of Project Information

During the 1967-69 biennium, the Independent Learning Project staff worked to meet their commitment to make the philosophy and results of the project increasingly available to interested teachers and administrators. Information about project purposes and methods has been dispersed through personal contacts with other educators and more formally through staff participation in the University of Chicago Graduate School of Education program and through a workshop organized by the Project and the Gifted Child Program of the State of Illinois.

### Personal Contacts

The Independent Learning Project has attracted many visitors and a steady stream of inquiries from teachers and administrators seeking ideas and advice concerning their own school programs. The project staff has welcomed this opportunity to share their work with teachers with similar concerns. A number of visitors have observed classes where newly developed procedures and curriculum materials were in use. Approximately 2000 visitors registered at the Laboratory Schools during the past two years, and the Independent Learning Project staff met with many who expressed interest in the work of the project. Although the majority of these visitors were from schools in the Chicago area, almost every state was represented in the total, and many letters have been received from schools and educators in other states. Most visitors were eager to hear more about the Project in the future and we hope that a more formal program of information dissemination will be developed to supplement these valuable but random personal contacts.

### Graduate School of Education

The Project staff has cooperated with the University of Chicago Master of Arts in Teaching program. Staff members participated in regular seminars in the Graduate School of Education, as well as contributing lectures and papers to seminars on special topics. Supervision of practice teachers has been another means for contact between staff members and the Graduate School of Education. Thus, by involvement in the courses of the Graduate School and by personal contact with future education professionals, the staff has had the opportunity to inform members of the University community about project activities and to receive the benefit of their suggestions and criticism.

### Cooperation with the Illinois State Program for Gifted Child Education

In addition to making information about this project available to interested educators from all parts of the country, it was of special concern to us to make our experimental findings available to teachers working in the Illinois State Program for Gifted Child Education. Our first hope had been to work directly with a Demonstration Center funded by the Gifted Program which would have concern for furthering the understanding of the relationship between independent learning and development of school programs. Although we found that there were Demonstration Centers philosophically closely allied to our work, these had prior special commitments to local programs which made it impossible for them to acept even a part of our program.

Following arrangements made with the Gifted Program staff in the Office of the Superintendent of Public Instruction, a one day workshop was organized in February of 1969, jointly sponsored by the Independent Learning Project and the Illinois Gifted Children Program. This workshop drew on a core of educators who had been involved in a workshop for teachers and administrators interested in independent learning which was held in the summer of 1967 under the auspices of the Gifted Program. The primary purpose of the February workshop was to present both the theoretical and practical considerations associated with the Independent Learning Project.

Professor Jacob Getzels and Edgar Bernstein made initial presentations concerning the theoretical aspects and general methodological assumptions underlying the Independent Learning Project. Their presentations were followed by sessions for subject matter specialists in English, Mathematics, Science, Social Studies and Drama. The concluding session was conducted by Professor Salvatore Maddi, of the University of Chicago Department of Psychology, who led a session on "Why Teachers Teach: Implications for Independent Learning." Follow-up letters to participants inviting their response to the workshop drew overwhelmingly favorable reactions to the program. The principal complaint concerned the limitations imposed by the one day format. Encouraged by this response, the Independent Learning Project plans to organize similar workshops during the 1969-70 school year, and hopes to hold a three or four week workshop in the summer of 1970.

Both of the Directors of this Project and other staff members have also cooperated with the State staff of the Illinois Gifted Child Program through participation in various meetings throughout the state. This cooperation began in May 1967 at a meeting in Edwardsville, Illinois for new project directors, and has continued during the past biennium. These meetings served particularly to alert the members of the project staff to the practical needs of the Illinois Gifted Program which might be served by an experimental project such as ours. At such meetings we have also gotten "feedback" which has been useful in our review of work we had undertaken. Contacts between the Independent Learning Project and other Illinois educators have been made and strengthened by these conferences.

## Publications

Quarterly reports on the progress of this project made to the Office of the Superintendent of Public Instruction have served as useful reference points for the Project staff. In addition, the Project Directors published a paper, "Independent Learning," in the Indiana Social Studies Quarterly, spring 1968, and have received a number of requests for reprints of this article. English, Math, Science and Drama staff members also prepared papers for the February Workshop which dealt with their specialized subject matter concerns in relation to the Independent Learning Project. These papers have also received widespread circulation. Curriculum materials developed by staff members have not yet been published, but are being used on an experimental basis in selected Illinois schools.

## Conclusion

The Directors and staff of the Independent Learning Project have been encouraged by the widespread interest and enthusiastic response to all phases of our dissemination of information regarding the Project. The contact with the educators involved in the Gifted Program has been particularly valuable. As our project progresses in its refinement of theoretical constructs regarding the place and nature of independent learning as well as in its development of methodologies and curriculum materials suitable for independent learning, it will be increasingly important to make our findings accessible. We envision a continuing series of workshops and publications, as well as less formal cultivation of personal contacts, in order to share our reflections and results with other concerned educators.

# SECTION III

## THE FRESHMAN PROJECT

A. Structure and Procedures

B. Research Data and Analysis -
Robert Crowson

C. Report on Student Interviews -
Laura Grad

# THE FRESHMAN PROJECT

The major research focus of the 1967-69 biennium, as with previous years, has been the ninth-grade program known as The Freshman Project. This program has been discussed fully in earlier reports;* the 1967-68 program was similar to earlier programs. Discussion of the structure and procedures of the 1967-68 program in this section is followed by analysis of the research data for that year (completed during the following school year). That, in turn, is followed by a report of student interviews conducted to examine the possible relationship between independence and home environment.

## A. Structure and Procedures of the Program

The staff included the teachers of ninth grade English, mathematics, science and social studies, two librarians, a counselor and a research associate. Teachers of freshman students in the arts and languages worked cooperatively with the project, but were not formally part of the staff.

The student population exhibits a range of academic abilities from normal to extremely gifted; the median IQ score as measured by the Henmon Nelson Test is 130. Enrollment at the ninth grade level fluctuates between 170 and 180 students; all freshmen were members of the Project. Science, mathematics, and social studies are elective courses at the freshman level, and English is required. Some ninth grade students were enrolled in only three of the four core subjects. Additionally, some students elected to take one of the ninth grade courses as sophomores, and they moved into the project environment for only one period a day, four days a week.

The project was centered in a suite of six interconnected rooms separated by moveable walls. English, mathematics and social studies were taught back to back in these rooms; when needed, these rooms could be combined into a large hall to hold the entire ninth grade class. Science classes met in laboratories outside the suite. A theatre with a seating capacity of about 150 was also available for use by any teacher(s). Students had limited free access to the well-equipped school library which contains between 20,000 and 25,000 volumes, periodicals (including the New York Times since 1910), pamphlets and maps, as well as other resource materials, such as 1500 phonograph records, art objects, artifacts, and mathematical models. It provided facilities for study, group conferences, student typing, microfilm reading, and student use of audio-visual materials. In addition, students had access to a quiet study room and to the cafeteria (the "noisy study" area). Closed circuit television and a wide variety of audio-visual equipment was available on semi-permanent loan for use by teachers and/or students in the suite.

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*For detailed reports, see Bernstein, Edgar and Ernest Poll, The Freshman Team Project (1961-62); Freshman Project Report (1962-63); The Freshman Project in Independent Learning (1963-65), Willard Congreve (ed.); and Report of the Independent Learning Project (1965-67), E. Poll (ed.).

Scheduling and Time Use. The four core subjects were taught within a five period block of time. The project classes met only three periods a week in required classes in each subject, though individual teachers could use those class periods as free work periods. In addition, students attended classes of their own choice within the "option program" (see discussion below). Within the overall block of time, flexibility of scheduling was available. With few exceptions, however, the schedule with which the year was initiated was maintained throughout the year. The following diagram presents The Freshman Project time block:

| Period | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| 1 | | | O P | | |
| 2 | | | P R<br>T O | | |
| 3 | | | I G<br>O R | | |
| 4 | | | N A<br>M | | |
| 5 | | | | | |

The Freshman Project Time Block (50 minute periods)

The Option Program. One day a week students were offered an option program, during which they could schedule themselves into a variety of learning activities presented in each subject area. Students made selections for the option day from schedules which indicated the time, place, teacher and nature of each option for each period. The nature of the individual offerings was determined by teacher team, individual teacher, student-teacher, and student planning. A wide range of specific activities was offered over the year. Students indicated choices on pre-perforated IBM cards that were turned back to the project staff when choices were completed. These cards provided a class list for each teacher on option days so that attendance could be taken.

An attempt was made to code the option activity "types" by using the following categories: remedial, review, development, enrichment and undifferentiated. Coding was obtained by correlating these areas with other learning activity specifications (such as teacher-led discussion, A-V presentation, field trips). A copy of the option coding form used by the project is found in the Appendix, Section J . This coding was the basis for analyzing student attendance patterns in the option program, discussed in the following section.

## B. Analysis of the 1967-68 Data

Robert Crowson

### Review of Past Research

The collection and analysis of data for the 1967-68 project was primarily concerned with an in-depth exploration of relationships between modes of student behavior and patterns of pupil success in various academic endeavors. Experimentation and research from the onset of this series of projects at the Laboratory School has been focused on efforts to provide, and to evaluate the effectiveness of, a school climate that would foster and reward independent learning behaviors, that would move students toward greater "self-direction" in their learning activities. Based upon findings from the previous four years of experimentation in independent learning, the 1967-68 project sought to provide operational measures of the degree to which a student's ability to take responsibility for the direction of his own learning activities is encouraged and developed within the milieu of The Freshman Project. The major research task for 1967-68 was refining and validating criteria on which to base assessment of the program with reference to these goals. It is posited that the ideal independent student is able and willing to engage and to resolve learning problems on his own both critically and creatively, is able to structure his own instructional activities and is able to select his own learning resources with discrimination. It is reasoned that, by training pupils to function without constant teacher-direction and by providing them with opportunities to plan much of their own learning, students will develop an enhanced sense of self-esteem and confidence in their abilities and will become able to exhibit greater initiative in seeking knowledge and understanding of the world around them.

Consistent with the attempt to train pupils to be independent learners by providing them with constant opportunities for student autonomy and control, considerable research emphasis has been devoted to: a) definition and development of operational criteria for measuring growth in independence; and b) evaluation of the program's provisions for some student choice of daily activities through a structure generally labeled the "option program."

### The Option Program

Although the option program procedures have varied considerably from year to year within the life of The Freshman Project, a few significant outcomes to date may be noted. At its inception, the student-choice concept was formulated in terms of individual pupil selection in each subject-area of the type of learning environment most suited to the student's felt needs. Three types of environment were available--- ranging from highly structured and didactic classes meeting every day of each week to minimally structured and dialectic programs of study that met as seldom as one or two days per week. An important research finding at the conclusion of this experiment was that there was no loss of achievement gain, as measured by standardized tests, among the students given greater autonomy within the minimally structured environment. Additionally, in response to a multiple choice end-of-the-year questionnaire, pupils who had been provided with greater freedom of choice felt they had learned to be comfortable when taking responsibility for many of their own learning activities.

Variations in student-choice procedures occurred during the ensuing years of experimentation. Generally, the option program from 1964 to the present has consisted of from one to two days per week of total pupil self-scheduling from among a wide range of activities. Pupils were allowed to structure their learning for each optional period at will, and were asked to record their time usage on personalized IBM cards specially prepared for option purposes. Activity offerings included access to library and study resources, science laboratories, school counseling services, study-skill consultants, and individual conferences with teachers. Also included was a varied menu of enrichment, remedial, student-planned, teacher-directed, group discussion, silent study, field trip, and audio-visual activities designed to allow broad possibilities for pupil self-direction and individualization in learning.

Because of the great diversity of activities, and the opportunities for idiosyncratic student variation in time allocation, effectiveness of the option program procedures has been difficult to assess and quantify. In an analysis of the 1965-66 project the option offerings were categorized as follows: (1) Curricular-related activities, (2) Non-curricular related activities, (3) Reference and study-skill activities, and (4) Counseling activities. In correlations between various student qualities and patterns of pupil choice among the four activity-types, it was found that the autonomous selection of activities generally followed observable student needs. Those pupils who scored low on a pre-test of reading proficiency self-selected more reference and study-skill options, and the majority of individuals electing to attend sessions with their freshman counselor were those experiencing academic difficulties in one or more subject areas. The most achievement-oriented students chose more of the curricular-related activities during the course of the year, while the pupils who most commonly selected non-curricular related (enrichment) options displayed indications of high ability but no outstanding degree of achievement orientation.

During the 1966-67 project, a similar procedure for option analysis produced additional evidence that autonomous student time allocation did not result in widespread mis-use of opportunities for self-directed learning activity. Individuals who most commonly selected "basic skill" options had low pre-test scores, were in the lower ability range of the class, and indicated lack of both self-confidence and interest in theoretical thinking. "Enrichment" options were most popular with the more individualistic and self-directed members of the class who had above average pre-test scores and high grade averages --- and who could apparently well afford to go beyond prescribed subject-matter curricula into learning areas of special interest. Analysis of student option selection by subject showed a tendency for pupil "specialization" in time usage, in that interest and achievement levels in each of the academic areas were closely related to the amount of time students devoted to each of the subjects.

Analysis of pupil-choice proclivities prior to the 1967-68 project year, therefore, indicates that needs, abilities, and interests are important determinants of "free" time usage when students direct their own learning behavior in the option program. The extent to which the option program has been a valuable training ground for the development of "independence" in attitude and behavior has not been clearly determined. Lack of objective criteria for assessing growth in independence from time ($t_1$) to time ($t_2$) has prevented valid measurement of the success of the program in leading individuals toward greater self-direction in their overall learning patterns. Past research can only be said to indicate that pupil autonomy in personal time allocation does not appear to have any major dysfunctional consequences in terms of academic performance, and it does appear to allow individualization in learning on the basis of idiosyncratic needs, abilities, and interests.

## The Assessment of "Independence"

Assessment of the degree to which a student is encouraged and aided to take responsibility for direction of his own learning activities necessitates a clearly formulated notion of just what independence is and how it is measured. The assumed theoretical relationship between such a deeply internalized personality characteristic as independence and the improvement of learning has provided a constant source of both frustration and stimulation in past efforts to define and quantify a set of independent behavioral criteria.

In the early years of the project it was necessary to accept an intuitive delineation of independence and to depend upon teacher-ratings for measures of self-directed learning outcomes. Independence was generally considered to be a fairly homogeneous behavioral construct and was closely tied to assessment of pupil learning styles. Rating of independent learning behavior was primarily based upon the degree to which a student was successful in solving and completing teacher-planned and teacher-assigned problems with a minimum of faculty assistance. The relationship between student independence ratings and other manifest indicators of pupil ability and achievement, as a result, was found to be extremely close. Generally, by definition, the independent individual was the academically successful pupil; the dependent person was the student who displayed little effort to hand his work in on time.

It was almost immediately clear that such a simplistic procedure for quantifying a criterion behavior left much to be desired. It was obvious that many highly successful students were very dependent persons, while many non-achievement-oriented pupils were in reality highly able individualists with strong independence capabilities. Furthermore, the same individual could be independent or dependent depending upon the conditions of the moment, the nature of a problem or task, his interests, and his needs. It became increasingly clear that independence and achievement were not interchangeable outcomes and that independence was not a unitary construct. The possibility that independence was not an outcome but an intermediate aspect of behavior affecting learning achievement was considered.

Consequently, during the 1966-67 project years, an attempt was made to develop a multivariate set of behaviors as sub-attributes of the general independence construct. And it was determined to consider independence in terms of differential personality characteristics rather than as an outcome to be achieved in the learning process. On the basis of teacher assessments of pupil characteristics, ten criteria for independence were delimited and formed into operational scales of pupil behavior. These were: self-directedness, self-confidence, diligence, aptitude, theoreticality, leadership, sociability, enthusiasm, poise, and individualism. The ten scale characteristics then formed the basis for the development of a pupil self-report instrument which was administered for the first time as a post-test in the 1966-67 project year and subjected to validating analysis.

Assessment of interrelationships between the ten categories of pupil behavior and various measures of ability and achievement for 1966-67 showed that: a) There was considerable variation in combination of self-report characteristics among students who had been identified as equally independent by their teachers; and b) There were significant differences from subject to subject and from teacher to teacher in the combinations of pupil characteristics that were most closely associated with academic success. It was found, for example, that one group of highly intelligent and seemingly quite independent students displayed a propensity for theoretical thought and very individualistic, non-conformist behavior. But this group of pupils was rated independent by teachers in only one subject area -- English. Another category of pupils, equally independent, scored high on the diligence, self-confidence, and self-directedness characteristics; this group was rated independent by teachers of science and mathematics.

An important overall finding for 1966-67 was that, when subjected to a step-wise regression analysis, the combined pupil self-report personality characteristics added significantly to an explanation of grade achievement in each academic discipline when intelligence and achievement test scores were held constant. This behavioral measure seemed flexible enough to allow for a number of differential modes of independence among learners and went beyond common measures of ability and achievement when explaining pupil success within an experimental program designed to allow greater student self-direction in learning.

However, the extent to which growth in independent or self-directed learning took place over the course of participation in The Freshman Project remained a research problem. The ten categories of pupil characteristics could not be considered criterion measures of independence, but rather were looked upon as facilitative categorizations of personality-types useful for comparing pupil responses to the freshman program. The independence behaviors delineated above were viewed as behavioral determinants affecting student achievement. The search for criterion measures became a major research task for the 1967-68 project.

## Research Goals for the 1967-68 Project

Research in 1967-68 was focused upon a multivariate assessment of the effect of The Freshman Project approach upon its pupil-clients. It was decided to take a close look at interrelationships between the various aspects of personality and performance as a further step towards the development of growth measures for independence. It was also decided to investigate the pupil choice aspect of the experimental program much more thoroughly than before, with careful control over the collection of time-usage data in the option program and with a careful study of relationships between option attendance and other student characteristics. A third task for 1967-68 involved a series of in-depth interviews with students who had placed themselves at opposite ends of one or more of the student self-report scales. Exploration of home and family backgrounds, peer relationships, and personality differences was undertaken for designated high- and low- independent pupils.

In seeking delineation of operational independence measures, an important step in the design of the 1967-68 research was the decision to use multiple outcome criteria, rather than a single measure of pupil independence. Consequently, the data analysis in this year was primarily concerned with interrelationships between multifaceted sets of student outcomes and selected predictors. An input-output model was defined for the analysis, whereby inputs of pupil background, ability, personality, interest, achievement-level, and skill-level would be compared with output measures representing self-directed learning capacities, divergent thinking abilities, subject-matter achievement levels, selected "self-concept" variables, and student time usage within the option program. Hypotheses to be tested included:

1. If pupil background, intelligence, tests of achievement and skill-level, and academic interests are held constant, there will be a significant relationship between each of the pupil self-report personality characteristics and the set of independence outcomes in each academic area.

2. If pupil background, intelligence, achievement and skill-levels, and selected personality factors are held constant, there will be a significant relationship between the academic interest measures and the set of independence outcomes in each subject area.

3. If tests for ability, achievement, divergent thinking, skill attainment, and personality are held constant, there will be significant relationships between the Bernstein tests for independence and the other outcome measures selected for analysis.

The exploration of such relationships between the multivariate set of outcomes and predictors had as an additional goal for the year the delineation of patterns of student response to the project for purposes of differential teacher-learner interaction in the 1968-69 experimentation. Therefore, analysis of the data also included examination of pupil attainment by type and category of student in order to move toward definition of a dependent-to-independent scale in future work. A description of the set of input and output variables used in the 1967-68 analysis follows.

## Description of the Variables

Initial analysis of the data for 1967-68 involved the treatment of over seventy separate items of information for each member of the Freshman class. Included within the input-output framework were pre and post scores for many of the standardized and teacher-constructed achievement and skills tests, a breakdown of student time allocation within the option program, pre-tests of student interests and personality factors, pre-post scores for divergent thinking or "creativity," pre-post scores for an independence measure labeled the Bernstein Q-Sort, teacher-ratings of pupils in each academic subject for independence and achievement, and additional variables related to student self-concepts.

1. Pupil background variables. A very small amount of quantifiable student data is available for control puposes. Measures reflecting pupil background are: Age, sex, years in attendance at the Laboratory School prior to the Freshman year, and the major ability measure -- the Henmon-Nelson IQ score.

2. Measures of student achievement. Standardized achievement data for each pupil was available in the pre-post administration of the Sequential Tests of Educational Progress[1] for writing, social studies, mathematics, and science. At a more specific level, achievement in each academic area was represented by the final academic grade in each subject -- English, social studies, mathematics, and science.

3. Indicators of skill prerequisites. Variables used to measure this category of input on a pre-test basis may be grouped into two categories -- study skills and conceptual skills. At the study skill level two measures of reading ability were available in a) an estimated Laboratory School reading ability score,[2] and b) a standardized reading score provided by the Cooperative Reading Test.[3] Library research skills were measured by a Library Skills pre-test administered annually to all Laboratory School freshmen. Conceptual skills were assessed in two subject areas -- science and social studies -- through the use of teacher-

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[1] Sequential Tests of Educational Progress, Cooperative Test Division: Educational Testing Service, Princeton, N. J., Los Angeles 27, Calif., Copyright 1956, Form 3A, Catalogue No. 153-01-1.

[2] Reading estimates are provided for each pupil by a reading specialist and consultant employed by the Lab School.

[3] Cooperative Reading Test: Cooperative Test Service, 15 Amsterdam Ave., New York City, Copyright 1941.

constructed instruments designed to measure understandings, concepts, and thinking processes considered necessary to pupil success in each of these disciplines.

4. Divergent thinking abilities. Pre- and post-tests of student creativity were provided by two instruments adapted from earlier research (1962) by Getzels and Jackson in the Laboratory Schools.[4] A Word Association Test presents a list of words to each subject--each of which has multiple meanings. The student is asked to write as many meanings as he can for each word. A Uses for Things Test presents the subject with the names of three common objects and asks him to write as many different uses as he can for each object. Copies of both instruments are provided in Appendices G and H).

5. Pupil self-report characteristics. Personality variables selected for analysis were provided in the administration of two instruments -- the Freshman Project Student Inventory and the I/E Inventory ( Appendices F & I). The Freshman Project Student Inventory produced pupil data for each of the ten personality characteristics discussed above. Combinations of these characteristics provided three additional "factor" scores -- a Sociability, Diligence, and Individualism measure for each student. A pupil who scores high on the pre-test for the "Sociability" dimension is considered to be friendly and outgoing, a leader among his peers, an enthusiastic individual, and a relaxed or "well-poised" person. The "Diligent" student is most self-directed, very hard-working and achievement oriented, is serious and reliable, and is confident of his ability. The "Individualist" enjoys analytical or theoretical thought and is comfortable as a nonconformist, or as a person who does his own thinking and is willing to question or to disagree with others.

The second instrument, the I/E Inventory, provides a "locus of control" score for each student. Pupils who score highly are considered individuals who have strong feelings of internal control over their environments. Low scorers tend to feel that the environment generally controls them. An additional variable is provided in a sub-set of the I/E Inventory as a dichotomous "Need for Structure" measure. The pupil who desires a need for structure indicates he is most comfortable with highly structured, teacher-dominated assignments in school.

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[4] Jacob W. Getzels and Philip W. Jackson, Creativity and Intelligence, (New York: John Wiley and Sons, Inc., 1962).

6. Academic interest variables. A measure of pupil likes and dislikes for each major academic subject is produced in a forced-choice questionnaire administered as a pre-test to each pupil in the program ( See Appendix I ). Scores of pupil interest in social studies, science, mathematics, English, and the arts are given.

7. Option time usage. A multivariate coding procedure for student option selection was provided in the data collection for 1967-68. Option offerings for each academic subject area during each week were cross coded for: a) type of option activity -- i. e. remedial, review, developmental, or enrichment; and b) method of presentation -- i. e. teacher-led, student-led, audio-visual, outside speaker, etc. ( See Appendix J for a copy of the option coding form. ). Variables selected for analysis include the percentage of available time each student spent in options in each subject area (including the library and the study-halls), and the percentage of time spent in each type and method of activity.

8. Indications of pupil independence. A measure of pupil willingness to engage in research and problem-solving activities, and to pursue these activities to conclusion, with little external teacher-direction is provided in pre and post administrations of the Bernstein Q-Sort. The Q-Sort instrument consists of 37 items related to the ability to inquire and to self-evaluate the results of inquiry. The instrument asks the student to determine which learning activities he perceives to be his responsibility and which he perceives to be within the province of the teacher. The higher the total score for a student, the more are learning activities seen by him as the responsibility of the student; the lower the score, the more are these responsibilities seen as appropriate to the teacher. At each administration of the instrument, students are asked to sort the cards twice -- once for the YOU (Y) sort and once for the TEACHER (T) sort.

Y-sort: Students sort the 37 cards to complete the statement "Whose job do YOU think it is to . . . " (i. e. decide how the student can solve any difficulties he is having in working on a problem, question or topic). From this sort comes an indication of the student's feeling about the degree of his own responsibility for directing his learning activities.

T-sort: Students sort the item cards to complete the statement "Whose job would TEACHERS say it is to . . . " (i. e. decide how the student can solve any difficulties he is having in working on a problem, question, or topic. )

> This sort indicates the student's estimation of the teacher's expectation of student responsibility for learning activities and indicates the values that the teacher projects to the student.

Pre and post scores for both Y and T sorts for each student were used as project variables. Two additional variables, Y/T ratios for both pre and post administrations, provide measures of the amount of congruence between student attitudes and their perceptions of teacher expectations.

A second set of independence variables was provided through teacher ratings of the degree to which each student "learned to take responsibility for the direction of his own learning activities" over the course of the school year (See Appendix K ). A single likert-scale score for each pupil in each subject area represents growth in independence as perceived by teachers.

## Preliminary Analysis of the Data*

Variable names, means, standard deviations, and zero-order correlations for the initial analysis of the 1967-68 research data are presented in Tables 1, 2, and 3. A large number of intercorrelations exist among the variables and may be reviewed by the reader for any specific relationships that are of interest. The descriptive and comparative statistics that seem most noteworthy are discussed in this analysis.

### A. Group Characteristics of the Students

Table 2 reveals the following:

1. There was a slight majority of boys. Using 1 for boys and 2 for girls, the mean was 1.47.

2. At entrance into the freshman year, students were somewhat younger than most ninth grade pupils. As of September, 1967, the mean age was 13.48 years.

3. The group as a whole did not have much prior experience in the Laboratory School. The mean years of experience prior to the freshman year was 3.09 out of a possible 8 years (including kindergarten). It may be noted that this group also had less Lab School experience than other freshman classes in recent years. (In 1966-67, the freshman class had a mean of 3.17 years of experience and in 1965-66, a mean of 4.21 years).

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*All Tables referred to in this Section are found in Appendix L.

4. The mean IQ of this 1967-68 class was 126.18. (In 1966-67, the mean IQ was 127.32 and in 1965-66, it was 128.38).

5. At the end of the 1967-68 year the average Bernstein Q-Sort independence rating for the Y-Sort measure was 80.91, compared to a pre-test mean of 77.53. There was a smaller increase for the T-Sort (pupil perception of teachers' expectations), from 77.92 to 79.67.

6. Of the total option time available to students in a twelve week sample chosen for analysis, 15.64% of student time was spent in English options, 13.40% in social studies, 11.72% in science, and 3.21% in mathematics. The remaining pupil time was allocated to study activities -- 34.02% in the library, 4.09% in the study hall, and 9.15% in the cafeteria (used as a "noisy" work and discussion area).

### B. Simple Correlations Among the Variables

A seventy-three by seventy-three correlation matrix is shown in Table 3. Some of the significant relationships between the variables are presented in summary form below:

1. Sex Differences. Contrary to previous years' findings, there were a few significant sex differences on 1967-68 measures of achievement and interest. Boys showed higher scores on both pre and post STEP tests for social studies, science, and mathematics, and they indicated greater interest in science and mathematics in responses to the Academic Interest Inventory. Girls, on the other hand, achieved higher scores on the STEP writing test, indicated greater interest in English, did better on the Uses for Things creativity test, and achieved higher English grades.

2. Age Differences. The older students displayed higher IQ's but less self-confidence in their academic capabilities than their younger classmates. There were no other significant age differences in achievement, personality, time-usage, academic interests, or independence ratings.

3. Number of Years in Attendance. Prior attendance in the Laboratory School did not affect student accomplishment in The Freshman Project, as measured by grade averages and independence ratings. However, students new to the Lab School did display higher STEP pre-test scores in writing, social studies, mathematics, and science -- and higher STEP post-test scores in social studies and science.

4. Skill Differences in Achievement. As expected, pre-tests of both study and conceptual skills were found to be significantly related, statistically, to the test and grade achievement measures that were used in the freshman program. Reading level, library skills, science and social studies understandings -- all were predictive of post-test scores on standardized achievement tests and of final grade averages in each of the academic subjects. A single exception was the lack of a relationship between library skills and final grade achievement in mathematics.

5. Interest Differences and Achievement. The pre-test examination of student interests, relative to each of the academic subjects, showed significant correlations between interest in social studies and performance on the STEP social studies post-test, interest in math and the STEP math post-test score, and interest in English in connection with the STEP writing post-test. In social studies there was also a relationship between pre-test interests in that subject and the final social studies grade. However, this relationship did not exist for science, math, and English.

6. Differences in Creativity. An interesting finding was the lack of relationship between high IQ and one of the creativity measures -- the Uses for Things Test. However, both of the divergent thinking instruments were predictive of final grade averages in all of the major academic subjects.

7. The Need for Structure. Pupils who indicated a desire for more highly structured and teacher dominated assignments at the close of the freshman year on the I/E Inventory displayed no differences from their classmates in ability and achievement. However, these students were rated less independent by their teachers in each of the academic subjects.

### C. Pre- and Post-Test Increments

Tables 4, 5, and 6 present tests for significant increases over time for three sets of instruments -- the standardized achievement tests, the creativity measures, and the Bernstein tests for independence.

From Table 4, it may be noted that the students displayed significant gains during the course of the year in learnings measured by the STEP Writing, the STEP Math, and the Cooperative Reading Tests. No major change is apparent for social studies and science -- not an uncommon occurrence for this project, in that the Lab School curriculum in these subjects is quite unrelated to the outcomes assessed by the STEP tests.

In Table 5, t-tests for the creativity measures indicate significant gain scores for both instruments. In light of these increases, along with the correlations between the creativity tests and achievement that were noted above, it may be stated that divergent thinking was promoted and rewarded within the Freshman Project program during 1967-68.

Table 6 presents tests for increase in independence, as measured by the Bernstein Q-Sort. The Y-Sort indication of each student's feeling about the amount of responsibility he should take for directing his own learning activities shows a statistically significant gain over the course of the year. A lesser increase is shown for the T-sort measure of teacher expectations for independence; and there is not a statistically significant decrease in the congruence between the two sorts, as measured by the Y/T ratio. A slight increase in this ratio above equality (100) indicates some feeling among the pupils that they exceed their teachers in perceptions of whose job it is to direct most learning activities.

## D. The Option Program for 1967-68.

Major assumptions underlying the provision of some degree of student autonomy within the option program are that: a) The open-ended scheduling of a portion of available pupil time will foster a greater individualization of instruction in terms of differential student needs, abilities, and interests; and b) The freedom to select some of his own learning activities "teaches" each student to be independent by encouraging him to function as a learner without constant teacher direction. As stated earlier, some evidence has been gathered from past research to partially validate the first assumption. Additional and more definitive data is provided on this question for the 1967-68 project year. However, the degree to which the option program fosters the goal of independence has again largely eluded attempts at evaluative analysis.

A sample of option data covering a twelve week portion of the school year was selected for an in-depth analysis. All of the findings reported here are based upon this sample, and not upon data for the entire year. Tables 7, 8, and 9 present breakdowns of option offerings by teachers in comparison with corresponding average time allocations by students. The data is shown by subject, by type of option activity, and by method of option presentation. It may be noted, initially, that a great deal of the pupil time (nearly half) was devoted to various "study" activities -- to library research, individual work in a study hall, or group study and discussion in the student cafeteria. Also of interest are indications that student choices favored the "enrichment" or non-curricular related options and options using audio-visual methods of presentation. Much less pupil attendance was given to "developmental" activities that were closely tied to the ongoing subject curricula or to remedial and review activities.

Additional option data of a general nature is shown in Tables 10 and 11. In Table 10, a matrix of intercorrelations for student selections by subject area and type of activity shows that option attendance for each discipline was rather limited in scope. Nearly all of the mathematics attendance was for remedial or review purposes. Most of the English and social studies selections were centered upon enrichment activities; and science attendance was principally for developmental reasons. Similarly, in Table 11 there is evidence that the same situation existed for methods of presentation -- in that mathematics attendance was heavily teacher-led, English attendance was generally student-led, science selections were usually for student-teacher conferences or for open laboratory work, and social studies options were concentrated upon audio-visual and teacher-led presentations.

Further analysis of pupil choice data through the comparison of interrelationships between option selections and measures of ability, achievement, personality, interest, and independence measures was concentrated upon the following questions:

1. Is there a relationship between option attendance and achievement? In social studies and in science there was a significant relationship between the percentage of pupil time given to each subject and the final grades that were received. This relationship did not exist for English and mathematics.

2. Is there a relationship between option attendance and independence? Once again, in social studies and science there was a significant relationship, but not in English and mathematics. Teacher ratings of pupil growth in independence for social studies and science corresponded with the amount of student time allocated to each discipline.

3. Does the option program aid individualization of instruction? There is some additional evidence that substantiates earlier affirmative data. The autonomous student selection of activities appeared in many

cases to reflect idiosyncratic learning needs and personality characteristics. Pupils who exhibited very low scores on the STEP Math pre-test for example, were most commonly involved in remedial and review mathematics options. Post-test Math scores for this group reached the average for achievement levels exhibited by the rest of their classmates. A similar occurrence was in evidence for English. Low scoring pupils on the STEP Writing pre-test attended more teacher-led and teacher-structured options in English for the time period sampled -- and their STEP Writing post-test scores were improved.

There was a statistically significant relationship between the percentage of student time given to student-teacher conferences and/or lab options in science -- and test results, grade averages, and independence ratings in that subject. Also, pupils devoting a larger percentage of their available time to social studies options had expressed a pre-test interest in social studies and at the end of the year they had higher social studies grades, test scores, and independence ratings.

Examining personality differences and time allocation, a finding of interest is an apparently close relationship between the "individualism" self-report personality characteristic and choice of student-led and/or enrichment options. The selection of student-led activities was also related to the "internal control" dimension of the I/E Inventory and to the Uses for Things portion of the post creativity tests. With this sub-group of individualistic Freshman Project pupils, then it would appear that freedom to plan and control some of their learning activities led to learning outcomes not unrelated to the stated goals of the experimental program.

4. Did the option program have dysfunctional consequences for some pupils? Mention is made above of the nearly fifty-percent allocation of student time to study activities. For pupils selecting library and study hall options most consistently, there appear to be no negative learning outcomes . However, slightly above 9% of student time was devoted to "cafeteria" study. The student cafeteria is available to students as an option choice throughout the day for group discussions, bull-sessions, relaxation, and pupil planning. There were statistically significant negative relationships between cafeteria attendance and test scores, grade averages, and independence ratings in each of the academic subject areas. With this sub-group of students, the opportunity to take responsibility for directing learning activities may have resulted in some opportunity to escape from responsibility.

## A Regression Analysis of the Data

As stated earlier in this report, assessment of predictive relationships between the variables for 1967-68 was undertaken in multivariate terms with multiple sets of outcomes and predictors. Hypothesized input and output relationships were discussed in order that the impact of The Freshman Project upon its pupils might be examined in its totality -- through a statistical procedure that requires all variables to be examined simultaneously in the context of the entire "system" of relationships.

Table 12 presents the categories of selected outcomes and predictors. Achievement, creativity, and independence form the sets of criterion measures that were examined for each of the major academic subject areas; while ability, creativity, skill prerequisites, achievement, academic interest, personality, and Q-Sorts for independence -- form the categories of predictive input. The data were subjected to a step-wise regression analysis -- a procedure for assessing the explanatory power of each independent variable upon each criterion, while holding all other variables constant.

Tables 13 through 17 present the regression results. In each of the tables one category of outcome measures is regressed for each variable representing the stipulated categories of input. The percent of variance in this outcome that is explained by each input is then presented. It must be noted that in a step-wise regression the explained variances are additive. Each variable introduced into the regression "adds to" the prediction, while the other independent variables are held constant. For each criterion the variables are analyzed in the order in which they are shown in the table. Using Table 13 as an example, it may be seen that the divergent thinking instruments explain an additional 8.4% of the final grade in English over and above that explanation provided by IQ or "ability."

### A. Hypothesis Tests for the 1967-68 Data

In a general overview of the regression results, it may be noted that the three hypotheses put forth earlier in this paper were only partially supported. It was hypothesized that, with other inputs held constant, pupil interests measured by the Academic Interest Inventory would explain a significant amount of each Freshman Project outcome. Generally, there was very little relationship between the pre-test of interest and post outcomes of achievement or independence. Some minor predictability for academic interest was found for social studies only. It was also hypothesized that the Bernstein Q-Sort for independence would prove an explanatory factor. The post-Y Q-Sort was introduced at the end of each regression and did explain a small amount of additional variance. Its major value is in showing that the degree to which students were willing to take responsibility for their own learning entered significantly into the ratings of pupil independence by the teachers -- especially in English and social studies. The remaining hypothesis was somewhat more thoroughly supported. The various personality variables in combination did have predictive power for most of the outcomes. For English, as an example, personality explained 4.5% of final grade average achievement and 9.1% of the independence rating. Personality was able to explain some 5.0% of the post Y-Sort outcome for independence.

## B. Intelligence and Creativity

There were two noteworthy findings in the regression results. One was that intelligence, as an indicator of ability, was not a very powerful predictor of success within The Freshman Project. IQ was introduced as a first factor in nearly every regression; but it was able to explain less than two percent of final grade achievement in English, and in no subject was it much above six percent. It was even less viable as an explanatory factor for teacher ratings of independence. And, as seen in Table 16, it predicted less than one percent of the variance in the Uses for Things portion of the divergent thinking measures.

A second matter of interest, on the other hand, was the rather strong predictive power of the divergent thinking instruments with the ability variable held constant. It was apparent from the regression results that pupil creativity played an important role in teacher assessments of achievement and of independence. Given the significant gain in the creativity score that was noted earlier in Table 5 -- and the interrelationships between achievement, independence, and divergent thinking in the regression analyses -- it may be concluded that the qualities measured by the Word Association and the Uses for Things Tests are not disregarded in the present experimental situation. A claim that divergent thinking is generally unrewarded in most classrooms makes this finding an important one for the evaluation of the freshman program.

## C. Achievement and Independence Ratings

It appears, from the regressions presented in Tables 13 and 14, that teachers in the four academic subject areas used different "rulers" in rating pupils for grade achievement and for independence. As would be expected, ability and achievement test measures were better predictors of grades than of independence. Creativity, the various personality factors, and the Bernstein Q-Sort showed more success as correlates of growth ratings for self-directed learning. It may be concluded that teachers in The Freshman Project have learned over years of experimentation to differentiate to some extent between subject matter achievement and student self-direction.

## D. Personality Characteristics as Predictors

The theorized predictability of such student characteristics as: a) the self-directed achievement - orientation factor, labeled "Diligence," b) the factor called "Individualism," c) the feeling of control over one's environment, and d) the ability to work without highly teacher dominated assignments -- were generally quite well evidenced in the regression analysis. The diligence scale was equally predictive of grade achievement and independence ratings in each of the academic disciplines -- and when held constant, is added to significantly by an included "Individualism" factor. An additional variable that appeared to have important predictability was the need for structure. In this case a desire for more highly structured assignments in school was negatively related to each criterion. The lack of a need for structure, therefore, may be seen in Table 14 to be a quite powerful predictor of independence ratings, with the other variables controlled. It would appear that students who are comfortable with little or no teacher domination are recognized and labeled "independent" pupils by their teachers.

The personality characteristics selected for analysis were hypothesized determinants of independent learning behavior. In combination, these variables explained 4.5% of grade achievement and 9.1% of the independence ratings in English; 2.6% of the grade average and 4.7% of independence in social studies; 1.8% and 7.3% respectively in mathematics; 6.7% of the grade achievement and 5.1% of independence in science. The personality measures were generally unsuccessful in explaining student performance on the standardized STEP post-tests for subject matter achievement and were generally unsuccessful in explaining the creativity outcomes. Although only 8.4% of the post Y-test of the Bernstein Q-Sort was unexplained by the pre Y-test used as a control variable the personality measures in combination picked up 5.0% of that remaining variance.

## E. The Regression Analysis -- Conclusions

The multivariate analysis of The Freshman Project data for 1967-68 was directed towards an evaluation of the degree to which pupil behaviors believed to be related to independent learning are fostered and rewarded within the milieu of this experimental program. The regression results presented here appear to illuminate a significant portion of that milieu. Divergent thinking outcomes, academic achievement, and ratings of student ability to self-direct learning activities are shown to be interrelated with their hypothesized determinants. Such inputs as creativity, diligence, a desire for little teacher domination, and a feeling that it is the student's responsibility to direct much of his own learning were differentially predictive of success in the freshman year. Although subject matter achievement and native ability were important to the Lab School program, as is the case for schools everywhere, it may be seen from the 1967-68 regression results that other factors related to habits of independence in thought and behavior were very much in evidence for this experimental situation.

## Discriminant Analysis of Student Sub-categories

A final goal for 1967-68 data analysis and experimentation was the delineation, on the basis of pre-test data, of student type-groupings for purposes of differential treatment during the course of the school year. Past research has indicated that there are many alternative student modes of approach toward the objective of self-directed learning, and that within the context of the Freshman Project program it is possible to individualize a significant portion of the learning activity.

In order to proceed towards a method and a rationale for establishing differential treatment groups of pupils, two scales of the student self-report personality instrument are compared for very high and very low designated respondents. Individuals who placed themselves more than one standard deviation above and below the mean for the DILIGENCE and the INDIVIDUALISM characteristics are shown in Tables 18 and 19. It should be remembered that DILIGENCE is an indication of achievement-orientation, self-confidence, and the ability to work intensively in a self-directed manner. INDIVIDUALISM measures the student's propensity for theoretical thought, nonconformist behavior, and readiness to question or to disagree with authority. It is theorized that a prior identification of high and low diligent and individualist students in future experimental programs would facilitate the attainment of achievement and independence goals.

if these varying modes of pupil approach are well known in advance. The low diligent student may be considered to be a not very self-directed or self-confident learner initially; he may need a greater amount of teacher-direction, or special assistance in attaining prerequisite skills, in order to begin to operate independently. His "highly individualistic" classmate, on the other hand, may require a minimum of structure and control -- and may well profit from as much opportunity as possible to plan his own learning and allocation of time. The following discussion of data presented in Tables 18 and 19 lends some credence to such differential methods hypotheses.

### A. High and Low Diligence

In Table 18, mean scores for a number of the 1967-68 variables are given for opposite ends of the Diligence distribution. It may be noted that the "Low Diligent" pupils had lower IQ's, levels of reading ability, standardized achievement test scores, final grade averages, independence ratings, and divergent thinking outcomes. The "Low Diligent" individual expressed a desire for a greater degree of structure and teacher-domination over his learning activities; and he spent a greater percentage of his option time during the year in the student cafeteria. Gain scores for this group on the creativity tests and on the STEP tests for writing and mathematics were well below the scores exhibited by their "High Diligent" classmates. This is to be expected in a program that emphasizes a "self-directed" form of diligence -- and it appears to call for special attention for these pupils.

### B. High and Low Individualism

In Table 19, mean scores are given for opposite ends of the Individualism distribution. In this case, it may be seen that the "highly individualistic" pupils are significantly more intelligent, are better readers, and are better STEP test achievers than their "Low" counterparts. On the other hand, while the "High Individualism" pupils were rated higher in independence by their teachers, there were no differences in final, subject area grade average performances for the two groups. The "High Individuals" were more creative, were willing to accept greater responsibility for their own learning, and desired less teacher-structure. They also spent less option time in teacher-led activities and allocated more of their time to student-led and/or enrichment options. The very individualistic pupil in the freshman program thus appears to be a very able, creative, and autonomous person who is not particularly achievement oriented and is not overly concerned with subject matter learning goals. He presents unique guidance problems to his teachers and

and would appear to benefit from an "individualized" program of study. His classmate, the "Low Individualism" pupil gave evidence of a decrease over the course of the year in the Bernstein Q-Sort independence instrument; and, like his "Low Diligent" counterpart, expressed a desire for much more structure and teacher control over the direction of his learning.

## Research for 1967-68 -- Summary and Conclusions

Data analysis for 1967-68 involved three major responsibilities: 1) definition and delineation of objective criteria upon which to assess student "growth" in independent learning, 2) determination of the overall, environmental effect of The Freshman Project philosophy and methodology of instruction, and 3) development of a rationale for grouping and differential treatment of pupil sub-groups for future projects.

A multivariate set of measures was used for the first time to form a composite picture of independent learning outcomes. A single, unifed growth score for independence was replaced by multiple indicators of divergent thinking abilities, academic achievement, rated self-directed behavior, and student willingness to take responsibility for self-structuring learning activities. The set of indicators in combination may be considered an operational measure of learning outcome for a type of education that goes beyond traditional school practice. Measures of environmental effect were wide-ranging, multivariate correlates of independent learning behavior involving indications of pupil ability, skill-level, achievement-level, personality, interest and attitude.

The findings were encouraging. The set of selected learning outcomes proved to be a viable measure of project effect. More important, such variables as creativity, a diminished need for structure, the ability to "self-direct" one's own learning, and the readiness to take responsibility for one' own learning were significantly predictive of student achievement in the program. It would appear that within the environmental context of this experimental program, "independent learning" is an essential characteristic of teacher-student interaction.

The "milieu effect" of the program received additional credit with the analysis of student choices in the option program. While the relationships between option attendance and increased independence were not visible, it was apparent that pupils of differing needs, interests, attainment levels, and attitudes were given the opportunity to regulate a portion of their learning time.

To some extent, the individualization of instruction, a necessary corollary of self-directed learning, seems to be provided for in an option program.

The environmental framework of the independent learning program had visibly adverse effects on some students who used the "free" time available in an option program unwisely. For students who were initially somewhat dependent individuals as identified in pre-tests of Diligence and Individualism, the less structured and more open-ended environment of the freshman year may not have produced significantly increased independence. On the other hand, it would appear that for the pupil who was already self-directed at the onset of his freshman program, the independent learning project offered a unique opportunity for a steady growth towards more creative, more self-reliant behavior. Special effort in future experimentation should be expended for the differential treatment of student sub-groups.

Freshman Project thought and procedures have changed substantially over the past years. Subject matter achievement and independent learning are no longer considered synonomous. No longer is independence a vague, singular, and ill-defined construct. It is now looked upon as a varied mixture of habits of thought, ability, attitude, and personal behavior that characterizes a person who is able and willing to structure his own learning activities. Over the years, classroom methodology, grading procedures, desired outcomes, and the elements of teacher-pupil interaction have steadily led to the development of an educational environment that gives evidence of meeting its goals.

## C. Student Interviews

### Introduction

The following paper resulted from our intention to test the hypothesis that the home environment has an important effect on the way in which a student will respond to an independent learning situation. Limited resources prevented us from making an exhaustive study including each student, so a limited number of interviews were conducted with students identified by tests as exhibiting "low" and "high" independence. Despite the limitation imposed by the restricted study, the insights gained are indicative of the complexity of problems involved in trying to establish an independent learning program. They are not representative of any definitive research.

It should be pointed out that our undergraduate interviewer, although having the ability to establish repport with the students, was not a trained educator or interviewer, and her report is far more subjective than would be the case if a more rigorous interview schedule had been employed.

# Report on Student Interviews

Laura Grad

## Procedures and General Considerations

Because the Freshman Project represents an attempt to foster independent exploration and self-education, the factors which influence the reactions of different individuals to the school environment must be closely examined. To draw any valid conclusions about the effects of the project without some information concerning aspects of students' lives which shape their attitudes and behavior seems inadequate. A number of freshmen were selected for interviews to solicit this information. The original plan was to write a rather structured, focused interview so that the responses of different students could be directly compared, but this approach presented various problems. First, a formal and rigid inquiry would inhibit the students and work against the purpose of exploring their personal lives. Further, such an interview would be extremely difficult to write because of the uncertainty about exactly what we were looking for; the goal was to develop rather than test a specific hypothesis. In such an open-ended situation, a formal interview seems inappropriate. The decision was made to conduct a number of unstructured, informal interviews with a small sample of students. Each student had previously been tested and rated according to several personality factors. Subjects rated very high and very low on the characteristic of "individualism" were chosen for the interviews.

The instrument by which students were classified for these purposes was not an objective test, but rather an inventory which provided a measure of self-image. Each student was given a series of statements describing personal characteristics and tendencies, some very general, others referring to specific situations. The student was asked to score each statement on a numerical scale estimating the degree to which it applied to himself. The scoring of the test was fairly complicated. "Individualism" was broken down into several more specific qualities believed to be contributing factors: self-directedness, self-confidence, diligence, theoreticality, leadership, sociability, enthusiasm, poise. The student was given a score in each area and the total was the sum of these separate scores.

The interview itself created a rather delicate situation for there were many difficulties to overcome, not the least was the mistrust of the students. As the interviewer I started with certain advantages. First, I am young, look even younger, and have often been mistaken for a freshman by U-High secretaries. Furthermore, I attended U-High for two years and am well acquainted with the tedium of the myriads of experiments and investigations conducted by the school. Because of these factors, it was not difficult for me to establish a sympathetic relationship with my subjects. Students were told that I was not working for the school, but on my own project as a U. C. undergraduate and had gotten permission to talk to a few students. This was generally sufficient: if pressed further, I said that I was trying to write an interview and needed to talk with students as a preliminary step. I appeared somewhat disorganized (partly a realistic portrait) and tried not to be official in any way. In the course of the interviews I discovered certain things which were very helpful in producing a relaxed atmosphere. First, I did not take any notes since students feel that they must plan every statement if it is to be recorded in the annals of social science. Second, I tried to overcome their normal reluctance to reveal personal information to a total stranger just because he happens to ask them to do so. When discussing school, family, and friends I did not hesitate to talk about my own life and some of my own problems. Often the result was lively conversations which gave me an opportunity to get to know the students as people. Once discussion began I simply followed their lead and learned much more than I would have by trying to direct the discussion myself. I thought it was more valuable to get a sense of a student's personality and general situation than to gather statements of opinion on specific matters, and therefore prepared only a limited number of questions to stimulate conversation. This is obviously an unscientific, unrigorous approach, but used carefully it may reveal information not elicited by a more formal procedure.

Before proceeding any further, I think it will be useful to examine more closely what is meant by individualism in this context, for the term has various connotations and can be ambiguous. One conception of an individualist is someone who differs markedly from other people. This generally implies resistance to the influence of the masses and a position founded on some kind of firm conviction. We attribute to this kind of individualist the ability to maintain his beliefs and act on them in the face of great obstacles. The individualism that I will be referring to is somewhat different and more relevant to the objectives of the Independent Learning Project. To begin with, the two essential elements are self-awareness and flexibility. The person with these qualities may or may not be different from most people, but this is not the important point. He must have a clear conception of himself as an individual and a self-confidence to recognize and accept his personal talents and limitations. Because he is aware of the differences between himself and others he functions with a certain amount of perspective in that he considers many alternatives, evaluating and choosing between them in terms of his own individual capacities and needs. One of the salient differences between these two kinds of individualists is that the latter must have a sense of control over his existence. He cannot feel that he is a pawn being manipulated by external forces. Because he is self conscious, whether or not he differs obviously from others, he consciously chooses his course of action. In this respect he accepts the responsibility for his life and this is impossible without some sense of freedom. In order to take decision making seriously, a person must believe that his decisions can make a difference. The individualist I described first also makes a choice: however it generally involves a sense of external forces trying to control his life and his policies are designed as defenses against these forces. Thus, the first kind of individualism is born out of fear: it is essentially a reaction against something. On the other hand, the second type is based on security and self-assurance and exists for its own sake. These two types of people will be markedly different in their behavior. The first will often be dogmatic and rigid, perhaps more so than the arch-conservative, status-quo follower of the herd. His energy is spent in survival, in keeping the wave of humanity from absorbing him into an indistinguishable nonentity with no self that is truly his own. The second, however, realizes that his life is what he and only he chooses to make it, so his chief concern is not survival. He is open minded because he feels safe; he can try the unknown because he is in control and can reject a decision if it fails to work out well.

After interviewing several students it became apparent to me that there was a serious flaw in the test that was supposed to reveal high and low individualism. The instrument described above does not distinguish between the two types of individualism because it reveals what students think they are and nothing more. Two of the subjects brought this problem to my attention, for I felt that both were misclassified. They also served as excellent illustrations of the two types of personalities just described. Elaine was rated very high in individualism. She is a complicated person difficult to describe in a nutshell, but a few characteristics will serve to illustrate certain points. She is an almost archtypal example of today's alienated youth. What was most immediately remarkable on first meeting Elaine was her overwhelming mistrust and suspicion of all adults. She is going through a stage where she feels that she has had some real insights into truth and beauty and the meaning of human life. She looks at the masses with vast bitterness and contempt and seems not only to want to reject them all wholesale, but also somehow to spite them. She feels immeasurably superior and views as a mark of her superiority her ability to look straight through the foibles and facades of others, revealing their real mediocrity. She considers analyzing people to be a kind of one-upsmanship, in that analysis leads to simplicity and in her world dignity requires complexity. She has a small circle of colorful friends who seem to share her abhorrence of hypocrisy and blind convention. Perhaps as a defense, and without realizing it, they have developed a social snobbery which surpasses that which they find so objectionable in others. Although she places great emphasis on her complete independence and takes pride in her ability to forge ahead alone in the face of terrific obstacles, I felt that she was rather intimidated by the isolation she had imposed on herself and that she consequently elevated her friends to an inviolable plain. Her self-image is one of complete self-containment, but her life has been a rejection reaction leaving very little to hold on to and she therefore chooses certain people and principles to cling to, for without them she is left in a vacuum. There are some people, herself included, who she does not subject to merciless probing for she needs them too much. Elaine's "individualism" betrays a certain lonely desperation.

At the opposite pole from Elaine is Denise who was placed in the very low individualism category. Denise is a very quiet and reserved person, very much on the little girl side of thirteen. The impression she gives is of a rather ordinary child, not spectacular in any direction. Overtly, her life could be termed conventional: there is nothing unusual apparent in the way she conducts her life. However after a very long friendly conversation, I became aware of the great strength beneath her unimposing exterior. Denise is not especially brilliant, and rarely performs impressive feats, but she does not look at her more illustrious classmates and become discouraged. Instead she views her accomplishments in the light of her own abilities and is dissatisfied only if she knows that she is not working up to capacity. This is not to say that she is fatalistic. On the contrary, she does not know with certainty just what her limits are, but she is willing to accept them when they become apparent. She is frustrated only by external hindrances and seems to suspend value judgments regarding her innate capabilities. Denise, although still a child, has the remarkable perspective that allows her to set her own standards. She is aware of herself as an individual and can distinguish between what is good in general and what is good for her. My impression was that she will consider all suggestions and whatever alternatives occur to her, but ultimately she makes her own decisions and has the strength to stick to them. This attitude colors all realms of her existence. In terms of the test for individualism, it is clear why she scored so low. Denise is an individualist in a very real sense; she accepts her way of life, her conception of people and the world. She is not aware of any other way to deal with the problems of being. She has never viewed herself as an individualist, because she never appeared to be different or special, and never aspired to stick out in a crowd.

The failure of the questionnaire to recognize Denise's type of individualism was revealed by the interview procedure. Nevertheless, although the instrument used has limitations, it can be a useful tool. With the exception of Elaine and Denise, I found that the test results reflected a certain degree of accuracy and will use the labels derived from them for purposes of comparison.

From the outset, there was a marked difference between the two groups in their initial reactions to the interviewing situation which provided a convenient point of departure for there were no exceptions and the evidence was quite unmistakable. The low individualists approached the interviews with suspicion. They behaved as though someone had set a trap so that unless they were really on their toes, they would somehow be taken in. They would examine me as if searching for a clue to what I was up to so they could plan an effective strategy. Most marked were the attempts to figure out what I wanted, so they could provide the right answers. They trusted me only if I could somehow make them feel that I was not one of society's henchmen sneaking up from behind. The high individualists on the other hand took a noticeably different view of the situation. They did not know any more about what was going to happen but, instead of apprehension, they reacted with curiosity and enthusiasm. For these students, the unknown does not by definition bode ill. Rather it holds a certain excitement which they await with eagerness. I found that I did not need to justify my existence or prove my innocence because they were not suspicious. For the most part, they were honest and assumed that I was talking to them because I was interested in what they had to say. Perhaps even more important was the attitude that I might possibly have something to say that they would want to hear. They participated much more actively in the conversation than the low group, who initially tended to answer questions in monosyllables, as if protecting themselves against some kind of invasion.

These were my first impressions. Naturally, all the subjects were extremely different sorts of people, although their common attitudes toward many things provided a very solid basis for comparison. A few generalizations will illuminate certain trends which should be examined. Concerning the option system and the Freshman Project as a whole, most of the low individualists had never given the matter any thought at all. They viewed the program as just another in an endless and tedious series of gimmicks and innovations dreamed up by the school for mysterious reasons or perhaps for no reasons at all. They seemed weary, skeptical, or completely indifferent. In any case, it had not occurred to any of them to speculate on the issue. Some of them conjured up elaborate explanations because I seemed to be asking for them, but it was clear that they had never considered the matter before. Individual reactions differed: some viewed the project with cynicism, and others simply assumed that the school knew best and that the wisest policy was to follow instructions. In both cases, the rationale was irrelevant to their major concern which was getting through intact. For this reason they tended to handle the options opportunistically, and enjoyed the system because if provided "free" time every Wednesday. Not one of them had ever made any plans for this time. One attitude that I encountered rather frequently in some of these students was a certain smugness at having outsmarted the school, as though education were a battle of wits with the school trying to pull something over on them or trick them into learning something. To go along with the system is viewed by many of these students as a defeat, so when they use every option to go to the cafeteria and fool around they feel as though they have discovered a loophole which the school has overlooked.

This attitude was particularly evident in one low individualism subject name Carl. I think Carl's reaction to his English class is worth mentioning. The teacher gave very loosely defined assignments, leaving the student a great deal of freedom to create and explore. Frequently she simply instructed them to write something, anything at all. Instead of the teacher grading the papers, they were submitted to the class for discussion and criticism. The class was designed to function as a community where students would learn from each other. The papers were returned with no grades and no comments by the teacher. Carl had no respect whatsoever for either the teacher or the class. He said that when she assigned a paper all you had to do was sit down for a few minutes and write almost anything that came to mind. Because it was not graded you couldn't really go wrong, so he gloated at how easily he could pull the wool over her eyes. The class bored him because the victory was too easy. He is interested in grades primarily as a means of displaying his intelligence; not any particular products of intelligence, but merely the fact of his intelligence. He seems to measure the worth of a teacher by how hard he grades. His social studies teacher is a case in point, with a reputation as a notorious slave-driver and extremely hard grader. Carl admires him as someone who is difficult to outwit. It is challenging to try not to be seen through and for this teacher Carl put more effort into the planning of his strategic maneuvers. Carl can approach school only in terms of grades which is why he cannot deal with the English class meaningfully.

Another more frequent approach to grading among the low individualists could be seen in Cathleen. Cathleen is a very good student, conscientious and hardworking and she usually gets extremely good grades. However, she needs grades to determine on a concrete, well-defined scale the value of her work. She seems quite incapable of making her own judgments, even on the most trivial level, such as the proper length for her skirts. In the same social studies class she felt extremely small, for she couldn't seem to please the teacher. In the same English class she was completely lost for she could not bear the uncertainty as to exactly where she stood, and was entirely dependent on some higher authority for structure and direction. Her preference for tests over essays is consistent with this lack of personal standards and is shared by the whole low individualist group. She feels that in writing essays it is too easy to go astray whereas, when the teacher specifically indicates information to be learned, the student is guaranteed success as long as he works hard enough. This points to a general attitude that there is one "right" response to every question or problem. Loosely defined assignments containing more unknowns require more skillful guesswork. For this reason Cathleen feels quite uncomfortable with The Freshman Project; she is willing to work hard so long as someone tells her what to do, freedom to choose disconcerts her. Furthermore she is very much afraid of making mistakes and trusts all authority implicitly. On the rare occasions when she does venture an opinion, she will abandon it immediately if even vaguely contradicted by an authority. For youngsters like Cathleen the universe is a very arbitrary system in which you either know the truth or you don't, but there is no way to find answers logically. She does not trust herself at all. The only way in which she learns anything about herself is by discovering what other people think of her.

Among the high individualism group there were differing attitudes toward school, but in tone they had much in common. First, each of them had definite ideas about the function of the option system -- most of them rather perceptive. Rachel for instance viewed it as a creative outlet in which students could do something with their individual interests and perhaps learn from other students rather than exclusively from teachers. She felt that the system was valuable if only because it provided a departure from the regimented school schedule which she finds quite stifling. Rachel is a very outgoing, self-confident, independent youngster who likes to take matters into her own hands and assume control. This is quite evident in her entire approach to school. For example, she organized an option which was quite successful. Her only objection to the option system is that it is not fully enough realized. Rachel was particularly enthusiastic about The Freshman Project because she functions best in undisciplined situations. She especially enjoyed her social studies ( a different teacher from Carl and Cathleen) and English (the same teacher) because she could talk freely with the teachers and had the opportunity to exercise her mind. Their flexibility allowed room for her to explore and expand which she said she had never been able to do in public school. As might be expected, she enjoys writing papers much more than taking tests, because she finds memorizing information boring while writing papers requires original and personal effort. All of this points to a very important distinction between Rachel and the students in the low individualism group: Rachel takes full responsiblity for her own work. When she does badly in a course the fault is her own for not working hard enough. She realizes that if she wants something she must work for it actively, that passive education is not education at all. Furthermore, she is not afraid to assert herself for she has great faith in her abilities. What is perhaps most important is that she is not afraid of failure, but willing to learn from it. Rachel is unusual in the high individualism group only in that she is extremely aggressive. Her basic assumptions are shared in varying degrees by the rest of this group.

Patricia, for example, is a very different kind of person from Rachel. But she is at least as independent and her individualism is manifested in similar ways. Patricia is a very quiet, unassuming girl with a genuinely warm interest in other people. In sharp contrast to Rachel she has no drive towards leadership and is basically non-competitive. She too find the second social studies teacher and the English teacher stimulating, and puts a great deal of effort into their classes. However, she differs from Rachel in that she is primarily interested in seeking an environment in which she can create. Rachel thrives within a lenient system because she feels that she learns better when she does it herself. She considers herself neither artistic nor creative: her talent lies in the ability to comprehend and to do this she needs to become involved with her work. In terms of these two girls, we can see that individualism is not a single personality trait, but rather a way of relating the world and the self with flexibility. Different as they are, these two girls share a great curiosity and eagerness to explore the unknown and the self-confidence and perspective necessary for self-fulfillment.

There was another basic difference between the high and low individualism groups regarding goals which is consistent with the emerging pattern. The low individualists all had some vague conception of "success" which they could not define but for which they had been trained to strive. They viewed school as a necessary means toward this vague end, which seems to exist for them in name only. For some, the end went no further then getting into college. Others viewed it as a "good job" or respectable status in the world. However, regardless of their particular ambitions, it seemed to me that in looking into the future they saw not themselves, but some person in the abstract. Also, they had no real feeling about what their projected lives would actually be like: they saw no connection between the substance of education and the effects they expected it to produce. Ken, for instance, deals with school very pragmatically and simply. He must do well in school so he can get into a good college, so that he can "get somewhere in life." He envisions college as career training in which you choose one field and study it exclusively. In high school, however a wide range of courses is necessary because good colleges require it. He sees nothing peculiar in this apparent contradiction, nor does he try to understand *why* colleges require general knowledge or what value it might have. This points to a fundamental attitude in the low individualism group: things are the way they are, whether or not they make sense or are understood by them.

The high individualists tend to be far more realistic about their goals. They do not deal in images and stereotypes. Their thoughts about the future stem from their present experience. Although their plans are no more clearly defined than those of the low group, the way in which they go about planning is vastly different. In the low group we have Carl who flips through occupational handbooks and decides which titles have appealing rings, but he has absolutely no idea what most of them mean. On the other hand, Elaine, a high individualist, who finds herself quite unable to work even when she wants to, is completely confident that when she gets to college she will be illustrious and make major breakthroughs in her field, whatever that turns out to be. For both of them the future is simply too remote to have any meaning. Rachel, also representative of the high individualists, has not yet chosen a career, but her projections into the future contain Rachel and not some anonymous adult figure. What is more, she does not want to make irrevocable decisions about the future because she feels that she will change tremendously in the next few years in ways which she cannot predict. She realizes that goals change as people change, and is more concerned with the process of becoming than with the end product. In other words, Rachel sees the future as a continuation of her life and not a final state to be achieved. She lives in the present instead of waiting for adulthood as a mysterious point at which life will suddenly begin.

### Attitude and Discipline in the Home Environment

There appears to be a very definite relationship between parental approaches toward child-rearing and high and low individualism scores. The parents of the low rated individualists tend to deal with their children as stereotypes with little consideration for personal idiosyncrasies. Their policies are based on standardized conceptions of the proper child and they try to impose qualities and interests from without rather than cultivating those which arise spontaneously. Ken, for instance, was teaching himself to play the guitar and says that he was working very hard at it. His mother, however, decided that this was a waste of time and forced him to take piano lessons instead because it would help him to become a more cultivated person. The fact that he hated every minute of it was not considered relevant. It comes as no surprise that no student in the low individualism group feels free to talk to his parents about personal matters. Contrasting examples from the high individualism group are Patricia and Denise. Patricia began violin lessons when she was six at her own insistence and still plays. Although her parents expect her to practise regularly, she said they would certainly not force her to continue if she lost interest. In general, they expressed great interest in her activities and she in theirs. Denise's relationship with her parents is slightly different in that she is viewed more as a child than as an equal, so her parents' concerns are rarely discussed with her. However, her parents are very receptive to anything Denise has to say and she feels quite comfortable talking with them. She is not entirely convinced that they always understand what she is saying, but she trusts them implicitly. When she comes to them with her problems, rather than presenting solutions or giving advice, they help her to understand her own feelings. They encourage her in her activities, but do not attempt to choose the activities for her. For example, she has always been an avid reader and they encourage her to read as much as possible by leaving her alone in her spare time.,

Another area in which the family situation tends to differ between the high and low individualism groups is discipline. In the low group discipline is an arbitrary affair. Often rules are established and decisions made exclusively by parents with no attempt to explain the rationale behind them. A typical approach by parents seems to be "No, because I said so. I'm your father, so I'm the boss." There is generally a rigid chain of command whereby one parent carries more weight. It seems that discipline and firm maintenance of authority must be guarded above all else, as if the parents are afraid of losing control at any moment. This is evident in homes such as Carl's where the father is dictator and the mother confined to trivial domestic issues. Often the mother will issue a command and not being very influential, encounters resistance. The father then steps in and whether or not he agrees with the mother, defends her on the principle that children must respect their mothers. So her power rests entirely on her husband. These parents seem to believe that respect, along with obedience, can be forced on a child. Another aspect of discipline characteristic of the low individualism group is punishment unrelated to the offense. Morality is imposed without purpose or justification. The basic attitude arising out of this kind of system is that everything the youngster does is for someone else. When he commits an offense, he is sinning against his parents. A mistake on a homework paper is a crime against the teacher for which he will be punished with a bad grade. But none of this has anything to do with his own personal concerns. Both at home and in school he does what he is supposed to only because it is expected of him -- it is a duty. This idea is of vast importance to the Independent Learning Project. Many of these youngsters live completely external lives. Their entire training has been the nullification of the self in that personal interests must always be subordinate to the imperatives of arbitrary authorities. It is quite possible that they have never conceived of responsibility to themselves. They are so busy manipulating the dictates and demands of the world that there has been no time to consider personal needs, or even a personal self. It has never been relevant or profitable.

Returning to the issue of discipline, a completely different arrangement prevails in the homes of most of the high individualism group. These parents feel a responsibility to develop in their children a real understanding of the underlying purpose and reason for morality. The family bears more resemblance to a community because the parents assume that they are to some extent answerable to their children for their actions. Authority is rarely the primary issue. Rules, policies and division of labor are determined by joint decisions in which everyone has a voice. The principle of obedience is not in itself a justification. With this kind of attitude a child can feel his importance as a person. He is a functioning member of the family, capable of understanding his role and his relationship to the group. We can understand how Patricia can say that her punishments are usually justified because she deserves them. In contrast, we can also understand how Ken can say that he deals with punishments by pitting his parents against each other, playing power politics.

# SECTION IV

# RECOMMENDATIONS FOR FURTHER RESEARCH AND ACTIVITIES

## RECOMMENDATIONS FOR FURTHER RESEARCH AND ACTIVITIES

Results of work by the Independent Learning Project during the 1967-69 biennium substantiate and expand earlier project findings. They also provide direction for future efforts in the areas of curriculum materials development, program development, research and workshops.

Curriculum Materials. Significant steps have been taken to date on developing curriculum materials in the areas of English, Mathematics, Science, Social Studies, Library and Theater. Future work should be directed to expansion of curriculum efforts, and to refinement and testing of all developed materials. Following the curriculum development model discussed on page 23, this would entail the following:

Mathematics:

Algebra -- writing, classroom testing, evaluation and revision of new materials (Units 7 through 12); evaluation, revision, and retesting of already developed materials (Units 1 through 6). These materials are for use at the ninth grade level.

Geometry -- writing, classroom testing, evaluation, and revision of three sets of materials projected for use at the tenth grade level.

English:

Literary Man: Writer and Reader -- classroom tested in selected schools, evaluation, and revision of this unit developed in 1968 to deal with critical reading and creative writing skills.

Initiation in Literature -- writing, classroom testing, evaluation, and revision of material which deals with the search for individual identity in society as this issue is treated in literature.

Social Studies:

World History -- evaluation, revision, and retesting of already developed materials for a two year (ninth and tenth grade) world history sequence combining selected historical content with social science concepts.

Afro-American History -- writing, classroom testing, evaluation and revision of materials for junior and senior levels which present the events, ideas, literature, art, music and objective conditions of Negro life in America.

Science:

Atomic Theory -- evaluation, revision and retesting of already prepared materials which develop scientific skills and attitudes through study of the history of this theory and through laboratory activities related to the atomic theory.

Perception -- evaluation, revision and retesting of already developed materials which deal with the range of interpretations in the field of perception and offer opportunities for independent investigations on this subject.

Theater:

Evaluation, revision and retesting of Scenery Design unit; writing of additional units (such as Costume, Makeup, Lighting) ; classroom testing, evaluation and revision of all units developed for use in high school theater.

Music:

Writing, classroom testing, evaluation and revision of materials which serve as a high school introduction to music, with an emphasis on individual music appreciation and appraisal.

Library:

Evaluation, revision and retesting of Library Tools, a set of already prepared programmed booklets used by students to develop their skills in library use.

The need for additional curriculum development beyond those projects listed above may become apparent in the future. Also, efforts at independent learning materials development for the lower school could become desirable and feasible.

Programs. Work on The Freshman Project from 1963 on has been productive and generally supportative of the view that, for most students, the independent learning environment has been effective. The positive results obtained in past programs have helped to generate current interest in expanding understanding of this mode of learning through investigation of a quite different independent learning program structure, the Student Ordered English Curriculum (SOEC). The SOEC is a single subject, multi-grade program which is more "open-ended" than The Freshman Project, with more flexibility in structure, scheduling, curriculum and student-teacher relations. Great premium is placed on responsiveness to student needs and concerns. While it shares with past programs the concept of offering independence within the boundaries of a given structure, the SOEC substantially expands and loosens these boundaries and contemplates active, effective student participation in the design and administration of the program.

Interest in such a fluid structure began with the classroom testing of Literary Man (referred to above) at three grade levels during the 1967-68 school year. The encouraging results of this trial and past experience with The Freshman Project led to the development of the SOEC staff and plans for a multi-grade program which was given rough formulation and trial during the 1968-69 school year. The staff felt that, in this "pre-pilot" effort:

1. Students worked harder and frequently did more homework when they could choose their own learning experiences.
2. Students recognized their own need and readiness for particular skills or personal enrichment.
3. Individual students verified teacher and standardized test diagnoses of what they needed to learn.
4. Older and younger, mature and immature students can and did learn with and from each other when engaged in a self-selected activity and when they shared a common interest.

Future program development by the Independent Learning Project would involve formalization of the SOEC program and investigation of its viability.

Research. Since its inception, a major research objective of the Independent Learning Project has been to evaluate the effects of independent learning programs and curriculum materials on student behavior. Research emphasis to date has been on the personality needs dimension of independence and dependence. Future research efforts should be directed to evaluating the relationship between personality needs associated with independence and hypothesized cognitive-intellective behaviors (termed flexibility and rigidity), also presumed to be associated with independence and dependence. The following questions provide focus for such a study:

1. Are some students more rigid (less flexible) than others?
2. What are the cognitive characteristics of rigid and flexible thinkers?
3. What are the deep-rooted personality needs associated with rigidity and flexibility?
4. What are some of the environmental origins of rigidity and flexibility?
5. Can a school program and/or its curriculum cause rigid thinkers to become more flexible?

Such a study would articulate with past project investigations and efforts. Between 1965 and 1968 much of the research concerned the development of operational measures of independence. In the course of that research a number of measures of personality needs* were developed which fit Bernstein's theoretical model of the independent learner.** Extensive testing with these measures indicated that they were valid predictors of different teachers' ratings of student independence, and of an objective test of independence (the Q-sort). These measures could be used in the proposed new research to discriminate between students of high need for independence and high need for dependence (see Step 4 - 1 in the research procedures outlined below). Having made such discriminations, this information would be correlated with data derived from use of newly developed rigidity measures.

In brief, pursuit of this research would involve the following procedural sequence over a two year period:

Step 1:

1. Analyze independent learning curricula and program in terms of the concept of rigidity.
2. Refine theoretical conceptualization of rigidity.

Step 2:

1. Construct operational rigidity measures.
2. Pilot test and, where necessary, revise rigidity measures.
3. Test rigidity measures for construct validity.

Step 3:

1. Revise independent learning curricula and program in terms of the rigidity concept.
2. Define sample experimental student population. Set up age, IQ, achievement controls.

Step 4:

Testing of research hypotheses:

A. Students of high dependence as measured in terms of personality needs will be more rigid than students of low dependence (high independence) at all times.

B. High rigidity students will show less movement toward flexibility than low rigidity students after exposure to information that clearly calls for flexibility.

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*Specifically, these measures are the Student Inventory (which measures, among other things, need for self-direction), the I/E Inventory (which measures feelings of internal control over the environment). See Appendices E and F.

**Bernstein and Montag, op. cit.

Research Design:

1. (September) Pre-tests of rigidity and personality needs measures on selected experimental population.
2. (September through January) Exposure of experimental population to experimental treatment, viz., to independent learning curricula and program.
3. (February) Post-tests of rigidity and personality needs measures.

Step 5:

Analyze and interpret data from Step 4.

Step 6:

Interview selected rigid and non-rigid students to obtain information about environmental origins of those traits.

Step 7:

Final overview of findings.

This research would complement and serve the projected curriculum materials and program development activities discussed above. It would improve understanding of these materials and programs; it would also provide information useful for revising the programs and materials so that they more effectively encourage non-rigid (independent) thinking. More generally, the proposed research could generate new information concerning the characteristics of gifted children. Construction of a rigidity measure should lead to improved understanding of intellectual development in these children. Finally, based on findings concerning the effects of independent learning curricula and programs upon rigid thinking, it should be possible to generate specific standardized procedures and/or instruments for curricular and program evaluation in other schools.

Workshops. Based on the evident value of past workshop activities, this project would see great value in the establishment of a program of workshops for purposes of both obtaining and disseminating information, ideas, procedures, results and curriculum materials related to independent learning. Such a program would include two kinds of workshops:

1. One-day single-subject workshops to be held during the school year. These workshops would provide confrontation with independent learning programs, materials and ideas as they relate to each subject area (i.e., an English workshop, a Mathematics workshop).
2. Four-week summer workshops (to be held for three weeks over the summer, with one-week follow-up session during the school year). These workshops would provide training, evaluation, and development opportunities with respect to independent learning programs, materials and ideas generally.

Videotaping. During the 1968-69 school year, this project established a videotape classroom and shot selected sequences of classroom use of Independent Learning Project materials and methods. The value of the produced tapes for both evaluation and dissemination purposes suggests the validity of expanded efforts in this area in the future.

# SECTION V

# APPENDICES

A. Independent Learning - Edgar Bernstein and Philip Montag
B. Independent Learning in Mathematics - Paul Moulton and Marilyn Thompson
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# APPENDIX A

# INDEPENDENT LEARNING

Edgar Bernstein and Philip Montag

# INDEPENDENT LEARNING

EDGAR BERNSTEIN AND PHILIP MONTAG

Discussion of independent learning might best begin with a definition of the independent learner: "one who engages problems which he delineates, and for which he develops and carries out his own plan of attack ending in knowledge gained and tested." Rather than being a description of a real student engaged in independent learning activities, this definition presents the characteristics of the *idealized* independent learner and stands as a statement of the goal towards which any program for independent learning must work. Looked at as a description of the real learner, this definition borders on the nonsensical—its applicability to most adults might be questionable. Accepted as an idealized model, this definition becomes a mechanism through which one can delineate the various qualities of the independent learner and, from this, the various dimensions of the independent learning environment.

The definition, in essence, describes the learner who engages in *inquiry*, and in *evaluation* of that inquiry, under his own motive power. For the ideal independent learner, one must assume the existence of a number of learning talents and characteristics. To begin with, he has all the basic skills necessary for him to proceed in the area into which he would inquire (i.e., reading, writing, computation). Additionally, it must be assumed that he already possesses the range of critical thinking skills associated with the formal processes of inquiry (the ability to define, to analyze, and to synthesize). However, these various skills, while necessary, are not sufficient to characterize the independent learner. One might have superb basic skills and be expert at the formal, logical procedures of inquiry and still fall short of learning independence.

One must turn to qualities associated with creativity to fill out the portrait of the independent learner. Consideration of specific examples helps to dramatize the difference between one who is merely skilled, on the one hand, and one who also has the qualities associated with creativity on the other. In the intellectual realm one must seek for the quality akin to Polanyi's term "intellectual passion."[1] It is a quality that is beyond the techniques and procedures characteristic of a particular field. In science, Kepler's announcement of the discovery of his third law[2] is laced with the excitement of discovery and puts forth the claim that this was a discovery made decades before it was actually proven to his satisfaction. By his own words Einstein had already sensed his theory of relativity at the age of sixteen: "From the very beginning it appeared to me intuitively clear that, judged from the standpoint of such an observer, everything would have to happen according to the same laws as for an observer who, relative to the earth, was at rest."[3] In mathematics, we have the renowned Gauss who is quoted as having said: "I have had my solutions for a long time but I do not yet know how I am to arrive at them."[4] The qualities that link all of these examples are importantly related to the creative impulse—the hunch, the flash of insight, the discovery. The range of affective characteristics associated with the creative impulse should be seen as necessary qualities of the independent learner. Finally, to complete the description of characteristics one must use such terms as involvement, curiosity, commitment, internal motivation, and confidence in one's own ability to confront and test insights and problems.

Consideration of these characteristics might easily lead to pessimism regarding the feasibility of "teaching" independent learning. Just how does one, for example, teach students to be intellectually creative? Certainly not by explaining or defining it! The conclusion must follow that one cannot teach creativity, and therefore, independent learning. But one *can* allow it to happen, encourage it, set the stage for it, and reinforce it when it does take place. In essence, one can structure a program in which idiosyncratic thought processes are valued, recognized, and rewarded.

It is fair to assume that most teachers will not find seated in their classroom an Einstein, a Rembrandt, or a Polya; but now and then there is a young individual who might be able to operate within the school setting along the lines of the independent learner. How might such a learner proceed if the school were organized appropriately for him? The independent learner would be director of his own learning, freely exercising idiosyncratic styles of thought to locate and organize given knowledge and conceivably to discover and test new information and ideas as well.[5] The independent learner would choose his own learning topics and problems. He would be able to make effective individual use of the time, space, and learning resources of the school.

He would locate the printed materials, audio-visual resources, and subject-matter experts (possibly including teachers) who have the expertise fitting his learning needs. Such a learner would schedule his own time, both to pursue his individual work and to participate in seminars. He would also schedule his own work area, within and outside of school, determining for himself those places which suited his particular work needs. As he pursued his learning concerns, the independent learner would constantly subject his activities and accomplishments to critical and effective evaluation. Classroom procedures for such an individual would be quite different from the traditional. They might be seminars in which ideas and materials would be presented, shared, and tested among the participants. The teacher would have a nondirective role, being a participant in the seminar as he earned that position.

For contrast, let us now attempt to sketch a portrait of the "dependent" learner in the school setting. The dependent learner would require an authoritarian figure to determine the subject-matter content to be studied and the ways and means to be used by the student on this content. This learner would probably tend to deal with the "received" truths and ideas of authorities, and be extremely reluctant to subject these truths and ideas to critical evaluation.[6] The dependent learner would proceed in learning with a regularized and formalized use of the time, space, and learning resources of the school. He would follow a time schedule which would provide for regular, frequent class meetings. The classes themselves would be limited in size, varying from small groups to a one-to-one relationship with the teacher. Large groups would be avoided. Within the class, there would be unchanging seating arrangements determined by the teacher. The location of class meetings would be unvarying; all subject-matter classes would be held in one room. Any variations in learning procedures would be initiated by the teacher and would be accompanied by very clear-cut instructions. Subject-matter assignments would be determined solely by the teacher, and would be accompanied by detailed instructions. These instructions would specify what the learner must do, what materials he must use, and where he would find these materials (including both the school location and quite specific bibliographic references such as titles, chapters, page numbers). Assignments would *not* be structured as problems which have some quality of the unknown. Instead, assignments would involve answers which are either correct or incorrect. This would make it possible for the learner to assimilate the facts and concepts determined by the teacher, to whom the dependent learner turns as the source of knowledge. Assignments would involve small discrete learning increments rather than broad and encompassing ones. Recommended time use would be provided for each assignment. Evaluation of learning accomplishments would always come from the teacher.

Individuals who fit these descriptions of either learner type are to be found rarely within the ordinary school setting. The descriptions, however, do provide broadly-drawn models with which to establish the following continuum:

"Dependent Learner" "Moderately Dependent Learner" "Moderately Independent Learner" "Independent Learner"

Most learners, and the school settings appropriate for them, fall between the two extremes described above. Students usually exhibit at least some growth, however modest, toward independent learning behavior. Accepting the furtherance of this growth as a valid goal of education, however, requires consideration of ways in which the learning environment should be patterned to move this broad and all-inclusive middle group towards the goal of greater independent learning. Unlike the environments described above for the dependent and independent learners, the learning environment for most students must be designed to *affect*, rather than to accommodate, learning behavior. Curriculum materials, classroom procedures, time, space, and learning resources should be designed into a concerted and explicit program which encourages the growth of independence in learning.[7]

The definition of the ideal independent learner stands as a statement of goals towards which the educational enterprise may direct itself. Analysis of the learning environment into its components makes it possible to focus on ways in which a school program can be structured toward the achievement of these goals. The accompanying diagram expands the continuum previously presented in terms of those specific learning variables which must be considered in any learning program. It graphically depicts that continuum for each of the learning variables, using the discussion of the "dependent learner" and the "independent learner" to establish the opposite ends of the continuum.

In general, such a program would attempt to move the individual student from whatever point of the continuum he is to be found when he enters school as far towards the goal of independent learning as he can manage. Ideally, a moderately dependent learner would shift in time from a setting which is predominantly teacher-structured to one which is predominantly student-structured and directed, as that

|  | "Dependent Learner" | "Moderately Dependent Learner" |  |  | "Moderately Independent Learner" |  | "Independent Learner" |  |
|---|---|---|---|---|---|---|---|---|
| LEARNING VARIABLES | A | B | C | D | E | F | G | MODEL |
| Student Role | Spectator | Active though not predominant role in learning activities |  |  | Active and predominant role in learning activities |  | Director | *The Independent Learner*<br>"one who engages problems, which he delineates, and for which he develops and carries out his own plan of attack ending in knowledge gained and tested" |
| Teacher Role | Director | Mentor |  | Resource gadfly |  | Critic | Spectator and/or Colleague |  |
| Teacher Methods | Didactic | Dialectic (Teacher dominant) |  |  | Dialectic (Student dominant) |  | (Consumer) |  |
| Curriculum Materials | Teacher-structured | Teacher-structured boundaries and resources |  |  | Student-structured boundaries and resources |  | Student-structured |  |
| Time and Space | Invariable | Teacher-structured. variable |  |  | Student-structured, variable |  | Fluid, Flexible |  |
| Evaluation | Teacher Evaluation | Shared, Teacher dominant |  |  | Shared, Student dominant |  | Student Evaluation |  |
|  |  | "Guided Inquiry" |  |  | "Open Inquiry" |  |  |  |

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student becomes more competent to deal with the various dimensions of the learning environment on his own. As his capabilities expand, he would move towards the use of those school settings which the moderately independent student already is using. Such a program, therefore, envisions a number of long-range changes taking place for students. The scheduling and use of time would be moved gradually out of the hands of the teacher and to the student. Similarly, the place where the student works would shift from the classroom to learning areas of the student's choice, be they library, individual study areas, group conference rooms, project rooms, or laboratories. Classroom procedures would change from those dominated by the teacher to those primarily initiated and directed by the students themselves. Curricula would shift from those which reflect the concerns of the teacher to those which are student-motivated; concomitantly, curricular materials would be structured more and more by the student. Finally, the selection and use of resource materials would come increasingly under the aegis of the student. Each of these variables would be used to press the student toward learning independence at a pace appropriate to his capacities. Each plays an important part in the construction of an operational program for independent learning.

In keeping with this discussion, it would be reasonable to assume that one might find student types ranging from A through G on the chart in any school; the point has already been made that *predominantly one might expect students to fall in categories B through F.* It is for student types B through F that we will discuss the variable kinds of independent learning activities. Broadly speaking, we would expect that the kind of program appropriate to students B, C, and D would be qualitatively different in essential ways from the program in independent learning constructed for students E and F. For the first, the program can be termed "guided inquiry," and, for the second, the term "open inquiry" will be used. It is important to note, however, that one would not necessarily specify the same point on the continuum for all the learning variables for a given student type. For example, for student type C one might construct a program which included somewhat more teacher structuring of the curriculum materials and information resources and *less* teacher structuring of the time schedule and the place where the student works. For student C, it may even be possible to push for fairly extensive self-evaluation. And finally, in a program for a type C student, the teacher may have to play a fairly strong and reinforcing role as the student proceeds. The teacher may very well mute[8] his role as critic in order to encourage student C in his efforts towards independence with some of the other variables. For student F, on the other hand, one might construct a program which presents a fairly high degree of teacher structuring of the curriculum materials (i.e., setting a list of specific content problems from which the student may choose a research task, and providing a range of bibliographic resources). For student F, once the curriculum boundaries are set by the teacher, his program would include a high degree of self-direction and freedom in terms of all of the other learning variables. The conclusion to which these considerations inevitably lead is that a program in independent learning must provide wide latitudes for individual variations. For, while it may be possible to establish a general structure for such a program, the specific implementation must vary according to the individual students involved.

Having established the components which comprise the learning environment of the school and identified the goal of independent learning, it becomes possible to discuss an operational program which would function to maximize the achievement of that goal. In general, this program can be conceived as a sequence of instructional activities which have the cumulative effect of bringing each student closer to the independent learning goal. The content of any given curriculum unit within the sequence would be determined by judgments as to which cognitive techniques, procedures, and understandings from a discipline enhance the student's ability to operate independently. Pedagogical techniques appropriate to the achievement of both content and independent learning goals would be built into each activity.

Several sets of experimental materials developed by the Chicago Social Studies Project can be used to illustrate the points discussed in this paper.[9] The examples which follow will be taken from Part I of *Greece: Selected Problems*.[10] This set of materials introduces the student to the ancient Greek civilization and, additionally, to concepts and perspectives from the social sciences. The first materials presented to the student are an assignment sheet and a document, under the general title of "The Unidentified Society." The student is told to read the document a number of times, and then make a list of words and phrases from the document which he thinks will be helpful in trying to develop a fairly complete picture of this society.[11] The students gather data during one class and then are asked to complete the assignment as homework and to bring their lists of data to class the following day. The teacher opens this second day of class activities by asking students to report on the data found. This is a free-ranging class activity with the teacher listing any and all student responses on the blackboard until students have exhausted their various lists.[12] When this point is reached and the class feels satisfied that all the important data have been gathered, the teacher refers them back to their assignment sheet to consider whether or not a fairly complete picture of this society has been developed. The answer is usually negative, based on recognition that the data in its present form is too confusing. The teacher then invites discussion of what might be done to solve this problem. Some members of the class will begin to make groupings of the data on the basis of apparent similarities. Other students will attack the problem by suggesting more general categories such as farming, tools, transportation, and weapons, and will then seek data appropriate for each category. The teacher encourages both styles, keeping track on the blackboard of students' attempts to organize the data. What emerges from pursuit of this task is considerable disagreement among students on just how to solve this problem of organization, and a recognition that the solution is rather complex. But students have themselves helped to generate the data by their own selections, and they have begun to develop their *own* organizations of the data.

Analysis of these activities provides the opportunity to consider ways in which they are consistent with, and contribute to, the achievement of the goals set for the unit.[13] The first thing that must strike the reader as he reflects on the activities just described is that they are highly structured. How, then, do such lessons contribute to the goal of creating the independent learner? Returning to the model of the learning environment, it becomes possible to see how these particular materials orchestrate the various components of that environment. What would be the placement of each of these components on the continua of the model? Looking at time, space, and materials and the decisions regarding these, it is immediately apparent that the options available to the learner have been greatly restricted. The time, although flexible, is limited to two or three class periods (and work at home); the space is essentially restricted to the classroom setting, except for homework activities; the materials have been limited to one "anonymous" chapter of the *Iliad*. All of these components, then, would be placed fairly far left on the continuum. The teacher-structured problem, although restrictive, is open-ended enough to require a substantial range of individual student decision-making. When the student is asked to select data from the document which would be helpful to developing a fairly complete picture of the unidentified society, he is given little guidance on what these tasks involve. Each student is required to determine *for himself* what might appropriately be listed on his data sheet and then how this data could be organized.

This decision-making role is carried over into the classroom also, where each student is given the opportunity to report some of his own findings.[14] The student role, then, would be somewhat to the right of the placement given to space, time, and materials on the continuum. The final component, the teacher role in the classroom, falls furthest to the right on the continuum, though even this would be well within the range of "guided inquiry" in the model. Once the assignment has been handed out, the teacher spends a great deal of time in a nondirective role. Students with questions are referred to their assignment sheets and generally encouraged to seek answers for themselves. In putting the data on the blackboard, the teacher merely serves as a "recorder," again being nondirective. Thus, through the mechanism of studying Homeric society, it is possible to organize the learning variables into a program of activities providing experiences associated with independent learning. This is done primarily through the role dictated for the teacher, which is fairly nondirective, and through the student role. Even though he does not define the problem or select the resources, the student still must decide what are appropriate data and then organize them. Although space, time, and materials have been rather tightly structured, through the assignments important areas for student choice and decision-making have been left open.

Following such introductory activities, the role of the teacher becomes more directive to establish the next problem in the Greek unit. This new problem requires each student to develop his own "filing-system," incorporating all the data developed previously into as many divisions and subdivisions as he thinks necessary. The final activity in Part I requires each student to write an essay in which he summarizes his findings from the earlier problems, describing as fully as possible what the unknown society was like. Each of these subsequent lessons can be analyzed in terms of the model, much as was done for the introductory assignment.

In general, it can be said that all the activities called for in the Greek unit fall within the realm of what has been identified in the model as "guided inquiry." Even the final projects, which students work on much later in the unit, limit the range of decisions available to the student. The components of the model are combined a little differently in these projects from the examples already cited by not requiring class attendance and by leaving to the student the problems of developing a plan of attack and of finding resources. However, students must work on one of seven teacher-suggested projects, complete the task in five days, and report their findings to the class. Thus some of the structure is maintained in these final projects. Yet the overall organization of the learning environment tends *towards* an "open inquiry" format more than the earliest activities of the Greek unit.

It should be made clear that, although the overall sequence of units in a year's study would be organized to move students progressively closer to the right end of the model continuum, there is by no means a perfect progression. Considerations of the peculiar characteristics of a given content area as well as the need for variations in student learning activities may dictate a moderate reversal of the progression in given instances. Even late in the sequence of activities within a unit, lessons may be given which greatly limit a student's control over decisions and hence his independence.

Most of the materials developed by the Chicago Social Studies Project[15] thus far would fall in the range of "guided inquiry." However, it is possible to suggest an example of what an "open inquiry" program would look like. In such a program, the student might be presented with an annotated bibliography which embodied a many-sided look at the modern city, its history and problems. The instructions accompanying this list would simply set a period of time (for example, one month) in which to read and sample as many of the titles as he chooses. At the end of the time period he would be expected to give to the teacher, orally or in writing, a statement of a problem which the student would like to pursue further. During the reading period to follow, there would be no scheduled classes, but the teacher would be available for conferences at the student's initiative. There would be no grades, but if the student wanted the teacher to critique the work as it progressed, this would be done.

The reader may recognize a similarity between the final projects in the Greek unit and this set of "open-inquiry" activities. This is to be seen particularly in that the topical boundaries are established by the teacher in both cases. But there are significant qualitative differences which dictate referring to this set of activities as *open* inquiry. There are the more obvious differences found in the greater freedom of work time and space. Perhaps the most significant shifts are to be found in the teacher's role, now highly nondirective, and in the student's role, which is more directive. The student in this situation is expected *to structure his own problem*, perhaps the most important qualitative difference between "guided" and "open" inquiry. Much of the guidance quality of "guided inquiry" comes from the fact that the subject-matter problems and topics are structured external to the student. Now the student must delineate his own learning concerns before embarking on his inquiry. The definition of the independent learner includes this type of activity, not to be found in the examples discussed earlier. It is our position that this is one of the more difficult learning tasks to be undertaken, and that broad-based experience with "guided inquiry" prepares the learner for later confrontation with "open inquiry" tasks. Having learned to conduct himself in learning within the structures provided by "guided inquiry," the student embarking on "open inquiry" activities can begin to learn how to handle a new dimension of learning with some confidence.

Let us turn once more to the "ideal independent learner." As noted earlier, most teachers are not often confronted with this type of learner in class. In fact, if he is seen at all it is usually outside the classroom, as, for example, in the following situations: in the hall or on the school steps talking and arguing some problem of interest, in the library obtaining information from books and periodicals, or before some informal group "reporting" his findings. Teachers might also know of such a student because he has requested the teacher to act as a resource, or because he has gained permission to leave school to take advantage of community resources, or because the newspaper writes that he has made a report to some group or organization. We do in fact recognize such a person because he stands out. How were his characteristics developed? Or more precisely, in what ways has the school contributed to the development of these characteristics? It is our view that the school has done too little, even in face of the fact that many schools publicly state as part of their goals the development of something akin to the independent learner.

Some schools are aware that the status quo must change if they are to achieve their aim, but in most cases changes have been limited to the manipulation of the time and space dimensions of the learning environment for economic purposes. Even though this may lead to observable and even dramatic breaks from past institutional arrangements, it does little in and of itself to accomplish the independent learning goal. It is the thesis of this paper that this can be done only through selective manipulation of the various dimensions of the learning environment. This means the variations of time and space when this seems sensible; more importantly, it must entail wide variations in teacher and student roles in class, and the development of assignments and materials which allow the differing roles to become operational. A curriculum organized with these considerations in mind would allow the teacher to evaluate not only student progress in the subject area, but also progress in acquiring those characteristics associated with the independent learner. Ultimately, through such a program, the teacher would be able to say with some certainty that her program contributed in important ways to the student's ability to operate independently.

## NOTES

1. Michael Polanyi, *Personal Knowledge:Towards a Post-Critical Philosophy* (Chicago: University of Chicago Press, 1958).

2. Johannes Kepler, *Harmonice Mundi*, Book V, Chapter 10.

3. Paul A. Schilpp (ed.), *Albert Einstein, Philosopher-Scientist* (Evanston, Illinois: Library of Living Philosophers, 1949).

4. G. Polya, quoted in Polanyi, p. 131.

5. The independent learner would exhibit the "divergent" intellectual abilities described by Professor J. P. Guilford of the University of Southern California, which emphasize multiple new experimental solutions to problems. See J. P Guilford, *The Nature of Human Intelligence* (New York: McGraw-Hill, 1967).

6. The dependent learner would exhibit the "convergent" intellectual abilities described by Professor Guilford, which emphasize single, correct, "safe" solutions to problems.

7. One cannot help wondering how many teachers, dealing with varieties of the "middle range" students, merely accommodate rather than attempt to affect student learning behavior.

8. Without eliminating it, of course.

9. The Chicago Social Studies Project (CSSP) has as its main purpose the development of materials for a ninth- and tenth-grade world history curriculum integrating history and the social sciences. This project was funded in 1966-1967 by the United States Office of Education and is currently being considered for renewal.

10. Andrea Pontecorvo Martonffy and Joel Surgal, *Greece: Selected Problems* (Chicago: Chicago Social Studies Project, 1967). These experimental materials are still in a trial edition and are not available for distribution.

11. The document used is Book XVI of Homer's *Iliad* with the Greek characters and place names replaced by "bogus" names. It is given to the student without discussion of its content or context.

12. Although it varies from group to group, the number of separate "words and phrases from the document" is always large, ranging from one hundred to two hundred items. In some cases this activity continues into the third day.

13. It should be made clear that, in describing these activities, we are not talking only in theory. These curriculum materials have been tested with students of quite different academic abilities and cultural backgrounds and the indicated pattern has consistently emerged. Some students will be distracted by trying to "identify" the society, but this only serves to sustain their interest in the task at hand.

14. The teacher can evaluate each student's ability to carry out the assignment by looking over the individual data sheets.

15. Other project materials are Jane Ashbrook, *India: Selected Problems*; Edgar Bernstein, *The Mystery of Torralba*; and Andrea Pontecorvo Martonffy and Thomas Newman, *Medieval Studies*. These are trial editions and are not available for distribution.

# APPENDIX B

# INDEPENDENT LEARNING IN MATHEMATICS

Paul Moulton and Marilyn Thompson

# INDEPENDENT LEARNING IN MATHEMATICS

Paul Moulton and Marilyn Thompson

A mathematics classroom is a very unnatural sort of place. If one asks what the value of mathematics is, he must step outside the classroom to look for his answer. He must look for his answer in the broad context of all experience, a part of which is completely dissociated from mathematics, a part of which is better understood with the aid of mathematics, and a part of which is purely mathematical.

If one were to judge mathematics instruction from what he typically sees in the classroom, he would conclude that the teacher had never stepped outside the room. He would find the students learning to manipulate symbols without appreciating the inherent characteristics of the symbols; he would find them acting in the capacity of onlookers at a scene whose essence is that it is the product of pure reason; he would find them performing the rituals of problem solving without solving any problems. He would find instead a group of students whose principal activity is following instructions and remembering.

Ideally a student emerges from his classroom full of curiosity, confident of his own reasoning powers, taking pleasure in a broad range of experiences, able to understand and to effect some control over the forces that impinge upon him, and with a useful store of knowledge. His spirit has been freed in the fashion of the liberally educated man. Typically, however, his freedom has been neglected or even curtailed by the experiences he has undergone. Typically he has come to find mathematics dull or distasteful, to be frightened by his mental inadequacies, to have had his curiosity stiffled, and to be hopelessly unable to solve a problem or conduct an inquiry. And these things have happened because of the limited sorts of experiences he has encountered in the classroom. He has played a passive role where he should have been given a chance to discover, to argue, to explore, to cope with problems, to participate individually and independently in the variety of activities that are a part of mathematical inquiry, pure and applied. Ideally, he has, in the sense of having played an active role and in having relied upon his own thought processes, been an "independent learner." He has -- perhaps in isolation, perhaps as a member of a group -- been responsible as an active individual to participate in inquiries in all their stages, not only in their outcomes.

Independent learning in the classroom occurs when the student is using his own resources to deal with the material in his own way.

He is searching for a discovery, an understanding, an explanation, an answer, or a solution, using the full capability of his own intellect both in the process itself and in the evaluation of the results. He is conducting an inquiry into some problem which he feels to be either useful, important or intriguing; yet he senses that it is manageable and believes that he can arrive at a satisfactory solution. Implicit in the process is a new insight or increased understanding of the problem.

This concept of independent learning is at variance with what is often called independent learning but which we would prefer to call physical independence, that is with a learning situation which is characterized by the absence of a teacher or other classroom constraint. This latter sort of independence may or may not involve independent learning, according to the nature of the activity itself. A student who goes to the library to work through a programmed text, for instance, is engaging in very little independent learning, since it is the characteristic of programmed texts that they meticulously steer the student through a completely predetermined sequence of thoughts. Another student who goes to the library to prepare a report, say, on the origins of the words used in trigonometry is likely to engage in a lot of independent learning. In this paper we will be concerned primarily with the means by which independent learning may be increased and very little concerned with granting the student physical independence, though the latter can be of real importance as a component of independent learning.

An inquiry -- large or small -- has three readily identified stages: 1) determining the aim of the inquiry; 2) conducting the exploration, research, and thinking; and 3) organizing and assessing the results. Typically students play a very passive role in all this. They watch an inquiry going by. They are told the aim, they are shown the steps leading to the goal and they are shown the outcome. Their job is to remember what they have seen.

There are rather practical reasons for this. Perhaps the most compelling is that the world has reached its present state of knowledge through centuries of inquiries conducted by the smartest people. For a student to reach the frontiers of knowledge, he must of necessity skip lightly over the work of centuries. Another is that for a person to conduct an inquiry he must have an aim of some sort. Choosing aims is an art and cannot be done willy-nilly. Naive students have little basis for deciding before an inquiry begins whether or not it will ultimately have proved useful. They are almost always forced to rely upon the wisdom of a more experienced society to point the way. And finally, the inquiry process is usually a lengthy one. It takes far longer to go through the inquiry independently than it does to watch someone who has already done it show how it was done.

These difficulties preclude making education a series of independent inquiries. They do not, however, force one to move to the other extreme and to eliminate independent inquiry from the educational process altogether. To do the latter is to cover the ground as far as facts and simple skills are concerned, but to leave the student lacking in those attitudes and inquiry skills which will make his education relevant to the living process. There must be a balance struck between covering the ground and doing so in a fashion which will allow the student to play an active role in learning and to have a taste of inquiry in all its phases.

Perhaps the most useful place to abridge the inquiry process is in the selection of the aim of the inquiry. Occasionally, of course, the student should be free to determine this. He should certainly be free to choose books, projects, courses, universities, professions, and such areas of inquiry. Furthermore within an area, there should certainly be enough slack that he can choose some of the aims. But for the major part of his education it is expedient that relatively little time be spent on focusing an inquiry and that a much larger portion be spent on conducting the problem-solving, data gathering, and assessment stages of the inquiry. If the teacher does nothing more than to let his students share in these latter stages of an inquiry he will have done far more than his traditional colleagues to make learning an independent, active process. It is with respect to the means by which a teacher can accomplish this that we wish to devote the rest of this paper.

Assuming that the teacher has chosen an inquiry which his class is to pursue, several considerations are essential:

1) The aim of the task must be clear, and the aim must be kept apparent to the student throughout the inquiry. The definition must be in terms which are familiar to the student andpresented in such a way that the student can intuitively comprehend the nature of the problem.

2) The problem must be "open-ended" in the sense that a variety of alternative approaches are permitted and none is specified or preferred. For when the teacher has a specific solution in mind, the activity often becomes one of "guessing the answer which Teacher wants."

3) Opportunity for feedback must be provided. The student should know that there are ways to test his results for himself.

4) The problem must be sufficiently involving that the student is willing to participate in its solution. In addition, it must have enough potential for solution that, with reasonable persistence, some sort of closure may be obtained.

In mathematics, many types of situations arise which can provide opportunities for independent inquiry. Several categories of questions which are particularly relevant to independent inquiry are listed below. These categories are not intended to be exhaustive or complete. Most of the examples cited can be used in a first year algebra course.

Discovery. The student is presented with a set of highly structured situations and is required to discover a pattern or to find a method for dealing with similar problems. For example, he might be given quite a few examples of solutions of linear equations and be asked to apply the procedures illustrated to solve similar equations. Or having found many "special products," he might be asked to factor similar polynomials.

Explanation. The student is asked to find a convincing rationale for some mathematical "rule." For example, he might be asked to explain why division by zero is not permissible, or why equivalent equations are not obtained when multiplying through by (x - 3).

Generalization. The student is asked to generalize from his work with a particular problem set or from his experiences over a longer period of time. For example, after solving many kinds of equations, he might be asked to design a flow chart which will outline a procedure for solving any kind of equation. Or, after graphing quite a few linear and non-linear functions, he might be asked to devise a method (other than graphing) for determining whether the graph of a function is a line.

Modeling. The student is asked to examine a specific mathematical object and to suggest a "real world" situation which could be represented by that object. Or he is presented with a problem and asked to devise an appropriate mathematical model which could be used to solve that problem. For example, he might be given an equation such as $y= 1.5x - 100$ and asked to describe a situation which the equation represents. Or he might be asked to construct a model for a particular production-cost situation.

System building. The student is asked to collect the properties which he feels to be particularly important and to work with them to form an axiomatic system. For example, he might decide what properties seem most important in simplifying algebraic expressions and then attempt to derive additional simplifying properities from them with a view to extending the set of axioms only when necessary.

The presentation of each of the five suggested areas requires some degree of structure from very little in generalization to a great deal of structure in discovery. All contain possiblities for feedback. All are open-ended in that the student will arrive at his own way of responding to the task.

Independent investigation is, of necessity, individual and personal. But by no means can one conclude that it must take place in isolation. Each of the categories of problems indicated above can be handled in a variety of situations -- even within the classroom setting. If a classroom is organized on principles of individualized instruction or mastery learning, such questions can be raised in the materials themselves in such a way that either individuals or small groups can deal with them when appropriate. If a classroom is organized in the traditional manner with all students studying the same topic at the same time, many structures lend themselves to independent inquiry. The class may be divided into several small discussion groups. Alternatively, the teacher may offer an "option day" in which students may elect to spend the class period either reviewing and obtaining special help on the material at hand or participating in an inquiry relating to the material. A third possibility is to pose the problem to the entire class and then to turn the discussion over to the students.

Regardless of the classroom structure employed, the role of the teacher, once he has defined the problem clearly and carefully, is primarily that of observer. Upon request, the teacher might answer specific questions, give pertinent information, or help briefly to move things along. But the class or discussion group is essentially "teacherless" as far as the activity of learning is concerned. The student learns that he cannot rely on his teacher to solve problems for him, but rather that he must devise his own methods of problem solving.

Many problems are faced by the teacher who would like to bring more independent learning into his classroom. One such problem is that most texts, including even the most recent ones, are essentially expositions which put the student into a very passive role. It is impossible, for instance, for a teacher to confront his students with a real problem if the textbook in its turn solves the problem for them. The textual material has to reflect not only the content of the course; it must also reflect the spirit.

Another difficulty arises from the speed with which material is covered. When the teacher acts as an expositor, he can move through a given body of ideas at an efficient, rapid rate. But when students are something other than passive listeners, much time is spent as students grope along making many futile attempts at a solution. Success in such problems cannot be guaranteed instantly. The necessary insights might take several weeks or months after the problem is initially presented.

Neither teacher nor student is comfortable with this approach. The student expects the teacher to explain a solution to the problem and continually calls upon the teacher to do this for him. The teacher, observing the agony which the student experiences, wishes to ease the pain by assisting him along. It is very difficult, if not impossible, to determine the amount and nature of assistance to give a student in order to facilitate the learning process and yet not inhibit his desire to order his own learning.

Nevertheless, much can be gained by encouraging the student to engage in inquiry in mathematics. The student has learned something about the nature of problem solving and, hopefully, has increased his ability to solve problems. He has learned that mathematical systems are rational, that there are reasons for mathematical phenomena, and that he can make sense out of much of mathematics. Hopefully, he has a more positive attitude toward mathematics, since he has found that he has more control over it. And, most significantly, he has learned more about the nature of mathematics through his participation in actively recreating portions of it.

# APPENDIX C

# INDEPENDENT LEARNING AND THE SCIENCE CURRICULUM

Jan Housinger

# Independent Learning and the Science Curriculum

Jan Housinger

The Natural Science I course at the Laboratory School was begun five years ago. Since its inception, it has been part of the independent learning program and has, therefore, focused on independent learning goals. The content has changed through the years, but its main goals have not had a content orientation. The emphasis has always been on the processes of scientific endeavor and the content studied has been thought of as exemplifying these processes. The way subject-matter goals are implemented greatly aids another main goal -- independent learning.

As an example of how content and process are handled, study of the atomic theory is used as a means of demonstrating how scientists proceed in their theory or model building. It was no accident that atomic theory was chosen as an example of model building. It was felt that not only was it useful for this purpose, but that it was also one of the most fundamental theories devised by scientists. The essential focus, then, is with the processes of science since these are the "muscle" of science (the rationale for this can be found in the now rather extensive writings of such people as Schwab, Gagne, and Bruner). However, it would be a gross error to deal only with processes without using some of the major currently accepted ideas of science as the media through which the processes become evident.

It was clear very early that one of the best ways for the student to understand the nature of scientific investigation was for him to become an investigator on a problem that he himself had delineated. Besides promoting the Natural Science I content goals, individual student-chosen projects would help to promote the overall goal of independent learning. Indeed, these individual projects helped to define the ideal independent learner in science: the scientist working on a problem of his own creation. In secondary science education, it is the student setting about to investigate his own interest who is cast in the role of independent learner.

Such has been the nature of the Freshman science course -- a high degree of process orientation, a concentration on some of the major ideas of science, and a commitment to individual research. The outline of the course has changed as materials are worked and reworked, and a great deal of time has gone into writing and setting up labs. In what follows, an overview of the three-part course is presented, followed by a more detailed description of the materials developed for a particular unit of the course. Hopefully, the narrative will prove to be of some help to those wishing to do curriculum writing in science to promote independent learning.

## Part I - (First Quarter)

The year starts with an investigation into the role of observation in science. In order to effect learning along this line, students do various readings from papers written by scientists noted for their ability to observe. First, they read an article written by Nathaniel Shaler, a student of Louis Agassiz. In this paper Shaler tells how he was initiated into the study of natural science and of the great demands put on him by Agassiz. The greatest of these demands was that reliance should be put on the information gathered through observation rather than on the information printed in books. This is followed by an article written by Henry Fabre. In this reading, Fabre presents his findings concerning the courtship behavior of scorpions. It is an amazing example of the utility of close observation.

After the students have this background reading concerning the role of observation in science, they begin an investigation of the Indiana Dunes State Park. In this investigation of the dunes, the students are asked to make various observations on the dunes park and to interpret these in order to determine if there is an ecological succession at the dunes (and, if so, to describe it). Throughout this activity, the students are given readings about observation and ecology. A field trip to the dunes is taken so that the students can make first hand observations. Also, slides are available so that the students can prepare for the field trip as well as refresh their memories after the trip.

From this investigation in which the processes of observation, interpretation and grouping have been explored, the study of the dunes proceeds by investigating another problem -- this time a problem of geological interest involving the sand. The main goals from this investigation are to explore the processes of experimenting, measurement, and inferring from numerical data.

Around 1930, Cressey wrote a master's thesis about the sand at the Indiana Dunes. Students read the introduction to his thesis. Cressey wrote his paper in such a way that it is almost obvious from his introduction what he is going to investigate without his ever needing to state it explicitly. Therefore, through a close analysis of his writing, the students are able to come up with at least a general idea of what Cressey studied. They then develop the question that Cressey had: "Do the small grains of sand become more or less dominant as you proceed inland from Lake Michigan?"

Through discussion of this question the students arrive at hypothesized answers. They then proceed to a gathering of empirical evidence that will be helpful in determining what seems to be the best answer to the question asked. The students are not given a procedure to follow for their investigation but, through their discussions one is developed. It takes between one and two weeks before a seemingly adequate lab procedure is developed. Because of this teaching strategy, each year the method for finding out an answer to the question has varied.

Every year the students have felt that the investigation will require a determination of some masses and the use of the bunsen burner. This undoubtedly results from the way discussion is led by the teacher, but it is never at the teacher's suggestion that these operations are first talked about. Instead the suggestions have come naturally from the students.

When the procedure is well developed, the students are given one month to work in the lab and collect their data. Afterwards, all come together with various bits of data and try to interpret the information.

During the one month the students are working in the lab, they have a large number of things to do. Before they begin to make the measurements necessary for answering the particular question they have developed, they have to learn how to use a balance and a bunsen burner. Rather than making everyone spend time on these activities, programmed learning texts for the bunsen burner are made available, as are a set of activities taken from the Time, Space, and Matter course used to study the balance. It is not required that everyone use these written materials. Students must, however, pass a series of practical exams before they can proceed to their major data-collecting job.

During the attempted analysis of the data, it is very difficult to come up with an answer to the question posed initially. In order to come to any meaningful analysis, it is necessary to develop some statistical tools (mean, standard deviation, Q-test, t-test). It is with the presentation of these tools and the subsequent final analysis of the dunes data that the first quarter comes to an end.

Part II - (Second Quarter)

The entire time during the second quarter is devoted to the process of theory building. Students begin with a number of activities that they carry out in order to develop the ideas of the atomic theory as originally stated by John Dalton. Most of the activities are stated in such a way that the student has to do quite a bit of thinking and has to accomplish certain steps before he can move on. Further detail regarding this unit will be provided below.

After the atomic theory has been developed and the ways of thinking necessary to develop such a theory explored, there follows an historical study of the theory of solutions which provides first hand knowledge of some of the ways scientists work in order to develop theories. Students study some of the controversial aspects of science as well as the personalities and emotions that are involved in scientific endeavors. This is done through the original writings of the men who developed, and some who opposed, the theory of ionic dissociation.

## Part III - (Third Quarter)

During this final quarter, students are expected to engage in an individual project of their own choosing. The entire course is ultimately pitched toward this individual project. The tools necessary to carry out the individual projects are developed in the first two quarters so that the student should be able to function easily in the third quarter. Preparatory to this individual project, each student is expected to hand in a project proposal for his third quarter work. Halfway through the second quarter, he is to have rewritten this project proposal in light of the conferences held during this period. Throughout the first and second quarters, the student is expected to turn in reports on readings he has done in preparation for the third quarter project. These readings might be exploratory readings done in search of a project idea; they might be readings he has done to better delineate his project; or they might be informational readings about the topic on which he is going to work. Also, the course materials are pointed toward this third quarter project. The statistics should be useful in interpreting data, ways of observing will be useful in gathering the data, and attitudes developed in the second quarter will be useful to the successful completion of a third quarter project. It is in the third quarter project that each student is given the latitude to proceed at his own rate on the problem that he, himself, has defined. Ultimately, then, all prior work can be seen as preparation for a rather substantial independent learning task during the third quarter.

## A Unit on Atomic Theory

Let us now take a closer look at the Atomic Theory unit which was recently developed by Judith Vertrees and myself, with the help of Edgar Bernstein. In this particular unit students provide themselves through lab activities with the data available to the scientists who lived around 1803. Students are provided the data, if necessary, by the teacher. They are asked to proceed in a stepwise manner to see what sense they are able to make out of the data. The activities and data are structured in such a way that students follow the same line of thought that early chemists, and Dalton in particular, followed.

The first task that the students have is to write a paper entitled "What is Atomic Theory?" This acts as a pretest to see what concept they initially have of the Atomic Theory. After the students hand in this paper they are presented with the four postulates of John Dalton:

1. All elements are made up of individual particles which can be neither created nor destroyed, called atoms.
2. All atoms of the same element are identical.
3. Atoms of different elements come together in simple whole number ratios to form molecules of a compound.
4. Atoms of different elements are different.

A discussion about the meaning of these postulates follows. As their next assignment, the students are told to pick out one of the postulates, to extract an implication from the postulate, and then to devise a lab experiment they can conduct which would test that particular postulate. When the students return to class, they are divided into groups according to the postulate they have decided to investigate. The people within each group discuss the various lab procedures they have followed. The objective here is to have each group choose to do those experiments that really seem to test whether or not the postulate is consistent with the data. Some groups might be able to develop three experiments, some two, some none. (The teachers also have in their supply of materials some experiments available for those students unable to come up with an experiement of their own.)

The students are then given time to do either their own experiments or the experiments that have been suggested to them. We analyze the results of the various experiments and find that the postulates seem to be in agreement with the data collected. This does not prove that the postulates are right, but only that they do not seem to be at variance with the data.

The results of one of the experiments made available by the teacher are analyzed in some depth. In this experiment students are given some copper oxide (called black powder) and told to find out what percentage of the total mass of the compound id due to the mass of copper atoms (called element A atoms) and what percentage is due to the mass of oxygen atoms (called element B atoms). Results indicate that everyone who did the experiment came up with the same percentages -- within the limitations of our experimental measurements. Along with data supplied for other compounds, it becomes possible to generalize that the percentage composition of a compound is constant: in other words, the law of definite proportions. Next students are given some percentage composition data for various sets of compounds made up of the same elements --

for example, Carbon Dioxide and Carbon Monoxide (called compounds I and II, made up of elements G and B). Students find that from this data they are able to make another generalized statement: "When compounds are made up of the same elements and we keep the mass of one of the elements a constant, the mass ratio of the remaining element in the compounds is in a simple whole number proportion." This is the law of multiple proportions. The students are then asked to think about some of the implications of this law. They find that if Compound I had the formula AG, then, from the data, Compound II must have the formula $AG_2$. They note that they are able to come up with an infinite set of formulae that satisfy the data. They realize that once you establish one of the formulae, the other is determined. At this point, the only way they can establish one of the formulae is to guess -- the same problem that Dalton had.

We then proceed to the task of developing a generalized equation that can be used to determine relative atomic masses. We lead the students by a series of questions, to which they supply the answer, through an analysis that enables them to come up with the relationship:

$$\frac{\text{Mass \% A}}{\text{Mass \% B}} = \frac{xa}{yb}$$

Where: x= number of atoms of element A in one molecule of compound
y =number of atoms of element B in one molecule of compound
a= relative atomic mass of element A
b= relative atomic mass of element B

Because of the work they did earlier, the students realize that the mass percentage data are information they are able to determine through experiment. But they also realize that they have no way of experimentally determining the remaining information of the relationship. The only way they can break through to a solution of the equation is to guess the x to y ratio or the a to b ratio. From the postulates, it seems that the easiest procedure is to guess the x to y ratio since this is supposed to be a simple whole number ratio (postulate 3). After they make this assumption, they are able to generate a table of relative atomic masses if they are given percentage composition data for nine compounds and are asked to develop a table of relative atomic masses from this information. Through discussion, they come to the realization that a good check on their guesses is to note whether or not the value for the atomic mass of a particular element is consistent no matter which compound is considered. For example, element B should have the same mass no matter whether it is compounded with element A, C, D, E, or F (postulate 2).

After deriving their own atomic mass tables, they find that different people get different atomic mass tables depending on what guesses they make for the x to y ratio -- exactly what the early chemists found. We next do an experiment, taken from the PSSC course, used to determine the size of a molecule. A drop of Oleic acid solution is spread into a monolayer on top of a tank of water. By making some measurements and some calculations, students can, using their atomic mass tables, make some predictions concerning the size of a molecule and how many molecules are necessary to get one gram of Oleic acid. With this we leave the investigation of the atomic theory (except for an optional reading which tells about the current status of the theory, and the post-test , a paper written by the students entitled "What is the Atomic Theory?" ). Hopefully an important point has been made. By making a theoretical framework, one is able to dream up experiments, to make predictions, to pull together all sorts of seemingly disparate pieces of data, and to explain some natural phenomena. In short, what a theory does for the scientist and what the nature of a theory is have become clear to students.

The above statement presents an overview of the science curriculum work being done currently through the independent learning program. In some ways it is not new, in other ways it is. The content is not significantly different from that contained in many courses. But the emphasis is perhaps different. There are constant demands on the student to fill in some of "the missing pieces" of the curriculum. For example, we don't tell the student how to go about his sand investigation; we have him determine this. We don't tell the student what Mr. Cressey is about to investigate; we ask him to figure this out from the contextual clues. We don't tell the student what the atomic theory is; we ask the student to go through the data analysis himself to see what he can come up with. And in the third quarter, we ask the student to determine a problem, determine a procedure, determine a time table, determine what equipment he will need, determine how he is going to get the various pieces of equipment, determine how he is going to write up his work, determine how he is going to analyze his data. In short, we put onto the shoulders of the student major responsibilities for his own learning. But it is our view that, in order for students to do this, it is necessary to devise curricula which give the student a fighting chance to find success in this endeavor by offering the necessary prior experiences needed for him to succeed.

# APPENDIX D

# THEATER, THE ARTS, AND INDEPENDENT LEARNING

Robert Keil

# Theater, The Arts, and Independent Learning

Robert Keil

The general education requirements of the secondary school student have long been identified and drawn, and include mathematics, history, English, and science courses. As methods of teaching have become sophisticated, subject areas have developed, new courses are fused into the high school curriculum (such as the specialized study of particular civilizations, creative writing, calculus, and microbiology laboratory courses). New academic studies are developed and older ones changed to make man's developing knowledge more available to the student. Courses of study, old and new, are seen as necessary for the student to take his place in our ever-changing, increasingly mechanized and complex world.

However, the new developments that have taken place have not spilled over into some aspects of the student's education. While educators can determine fairly effectively what the student knows and how he's going to learn it, what about how he feels, what he does with his frustrations, how he interprets a human experience, or what he does to fill his leisure time? What about his aesthetic self? The usual rejoinder (sometimes defensive) is that most high schools have arts courses, and larger schools even have theater courses. Arts courses, varied in number and kind, have been taught almost as long as many of the academic subjects. But the point here is not the length of existence or the number of courses. Rather it is a question of how non-academic courses have fared with reference to incorporating new developments and methods in comparison to their academic partners. For the most part arts courses have been taught the same way for decades -- the same materials and methods of approach have been used without sufficient concern to the need for educational improvement to fulfill the needs of today's student. The position that man's intellectual horizons have changed, but his aesthetic needs have stayed basically the same is hard to justify. A sophistication in one has been accompanied by and demands a balance in the other. But, for a variety of reasons, that balance has not been provided by teachers of the arts in secondary education.

Avenues for innovative thought and the development of new methods and materials have been offered in recent years by the Independent Learning Project to teachers in many fields concerned with improving education for today's student.

I am a teacher in an arts curriculum -- theater. Theater courses are a relatively new addition to high school offerings, but they suffer from the same malnutrition as most other arts offerings -- the lack of a variety of approaches, methods and techniques designed to provide fully for the education of the high school student. Being an art form has not kept new ideas, fresh information and different attitudes from occuring in theater. But most courses in acting, technical theater, playwriting and theater history are still watered-down versions of old college courses without consideration given to orient the subject matter to secondary school learning situations. It was precisely because of this that I began to work with the Independent Learning Project.

The problem in relating any art field to independent learning seems to be one of teacher-student relationships. Since most students have limited or no background in either the methods or the esthetics of these subjects, the teacher usually plays the role of ultimate authority and resource. The first and perhaps most difficult step in making independent learning possible in any arts course is to change the teacher attitude toward student ability and to adjust the projected goals of the course. Instead of being strictly teacher-oriented, classes must have the flexibility to be student-directed. As pointed out in the journal reprint on independent learning by the Co-Directors of this Project -- there are variations in how independent individual learners are and how independent learning situations should be structured. In an arts course, where heterogeneous grouping is expected and necessary, flexibility and awareness of individual learning needs is demanded of the teacher if freedom for independent learning is to occur.

Defining the independent learner, providing for teacher flexibility, defining new goals, and then incorporating these into materials for classroom use were major tasks faced in structuring independent learning situations for the theater. This required creation of a new kind of course rather than inclusion of something new within an already existant structure. Acting and directing were areas not included in the initial plans for curriculum development because of the high degree of personal involvement they require (although the more I have worked with the new course, the more it seems possible to include them). The area of technical theater, on the other hand, lends itself to independent learning situations because of the concrete materials and the kinds of activities involved. As work progressed; it became necessary to widen the technical area to include related areas of theater production. The course, entitled Theater Arts Survey, includes individual units subtitled Scenery Design, Publicity, Theatre Architecture, Costuming and Makeup. It is essentially a survey course set for a 12 week quarter system to include two four-week units of independent study, and two two-week units during which the class exchanges information on individual projects so that every student is aware of the relationships between his and all other projects.

The curriculum materials of the course include sixteen different units or packages. Each package contains the material (written and/or graphic) which provides information about one specific area of theater production. Included also is a bibliography, a sheet of instructions to help the student get started, and a list of the project requirements. After a brief explanation about each package, each student is free to choose the subject package he would be most interested in pursuing for the next 4 weeks. He then begins his independent study unit.

Instead of regular class meetings four times a week during this independent learning time, regular conference hours are provided twice a week for each student to discuss problems and ask questions. These conferences also make it possible for the teacher to keep a regular check on the work being done. Conference times are grouped according to package topics so that students working in the same or related areas can exchange ideas and information, or just discuss similar problems and approaches.. During the conferences, each student also fills out a weekly progress report which goes into his class file.

In addition to the requirements of each subject package, which must be completed at the end of the 4 week period, every student is also required to conduct a half-hour symposium for the rest of the class. In the symposium, the student explains his particular area, outlines his project work and demonstrates the results of his work on the package. During the symposium the rest of the class is expected to take notes on the unit topic and its relation to the theater field. After each unit, all students are tested on the same material. This end-of-the-unit procedure provides similar learning expectations for all students. Each has spent semi-structured study time on his own project, has met a set of requirements, has had to prepare the material so that other students can understand the scope and relationship of his work to the other areas. He has himself been responsible for seeking the interrelation between the different theater areas. And finally he takes a cumulative test over all the units. The student is evaluated on a variety of levels with the flexibility of one level of achievement and response being able to influence another.

Six weeks of the quarter have now been covered. Each student is again asked to choose his area of theater study. But instead of repeating work on a strictly individual basis, the class is now divided into production groups, with each group having a main scenic, lighting, prop, costume, makeup and sound designer. There is also a business manager and a publicity person. The main difference from earlier work comes from the fact that students are now expected not only to fulfill the individual package requirements, but to function as a member of a hypothetical producing group -- all working together to produce the same play, in the same theater, under the same budget, meeting the same deadline -- the end of the 4 week unit.

During the final two weeks of the quarter, the production groups trade their planning and work experiences. A symposium format would again be followed for this, but now more time can be spent discussing and explaining the process leading to the end products, instead of merely the results of their work. Ideally, the primary goal of the survey course is thereby achieved. Each student has both specific and general knowledge of the methods, problems and procedures involved in the production of a play for legitimate theater. And this has been achieved by involving each student actively in the learning processes by which this goal has been achieved.

This independent study course is one example of the kind of changes that theater and other arts courses must undergo to get back in stride with their academic partners. The use of independent learning techniques may not be the salvation for every activity in every art field, but it will indeed stimulate the teacher's imagination and make him more perceptive to the learning needs of today's youth. And, hopefully, it meets some of those needs.

# APPENDIX E

# FRESHMAN PROJECT STUDENT INVENTORY

# Freshman Project Student Inventory

To the Student:

On the following pages there are 110 items dealing with students' activities and attitudes towards themselves. You are asked to indicate on a separate answer sheet what your personal response is to each question in the list.

The items in the inventory deal with the things you usually do and the way you do them. Your careful answers will be very useful in the development of better educational techniques in future years.

Your answers, however, will be regarded as strictly confidential. In no way will this form have anything to do with marks or grades in your courses.

You should try to answer every question. But if there is any item you would prefer not to respond to, leave it blank.

DIRECTIONS: For each statement below mark on the answer sheet the one of the five choices which best describes how the statement or word applies to you. Make a firm black mark.

Regarding the things I do and the way I do them, this statement describes me:

A. extremely well
B. quite well
C. fairly well
D. slightly
E. not very well

1. I'd enjoy speaking to a club group on a subject I know well.
2. I am friendly.
3. I do not like to tell other people what to do.
4. It bothers me to be with someone who dresses carelessly.
5. As soon as I finish one project or assignment, I always have something else I want to begin.
6. Before I start a task I spend some time getting it organized.
7. I am a fast walker.
8. People seem to think I get angry easily.
9. I am relaxed with other people.
10. I spend a lot of time thinking.
11. People consider me responsible.
12. I like to do things systematically.
13. People seem to think they can count on me.
14. I am energetic.
15. I like to make decisions.
16. People consider me tactful in dealing with others.
17. I go out of my way to be with friends.
18. I like to set my own deadlines and goals.
19. I often worry about my grades in school.
20. I am hard-working.
21. I am usually at ease.
22. I feel that there isn't enough time to do all that I want to accomplish everyday.
23. I often lose my temper.
24. I enjoy friendly arguments with my friends or my teachers.
25. I make good use of most of my time.
26. People consider me shy.
27. I am imaginative.
28. I learn best by memorizing.
29. It bothers me when other people disagree with me.
30. I am reliable.
31. I find it hard to keep working toward long-range goals.
32. People consider me good natured.
33. People seem to think I am enthusiastic.
34. I seldom get excited about things.
35. When I say I'll do something, I get it done.

Regarding the things I do and the way I do them, this statement describes me:

A. extremely well
B. quite well
C. fairly well
D. slightly
E. not very well

36. I like to do things my own way.
37. People seem to think I have a good sense of humor.
38. I feel uneasy when I disagree with my teachers.
39. I seem to be more interested in my schoolwork than most people.
40. People consider me an efficient worker.
41. I am able to assert authority over others.
42. I like to spend a good deal of time by myself.
43. When I have a problem, I usually ask other people for help.
44. I am well-organized.
45. I am a strong believer in customs and traditions.
46. I am outspoken.
47. It bothers me to leave a task half done.
48. I never hurt another person's feelings if I can avoid it.
49. I like to be with people most of the time.
50. People consider me level-headed.
51. I am full of pep and energy.
52. I enjoy seeking the answers to problems.
53. It takes me a long time to make a decision.
54. I am considerate.
55. I am easy-going.
56. People consider me a loner.
57. If I don't agree with the decisions of others, I go my own way.
58. I often seek the advice of my teachers when doing school work.
59. I am often worried.
60. I never seem to get things done on time.
61. People consider me to be a serious person.
62. I prefer having other people make difficult decisions for me.
63. People consider me the quiet type.
64. People consider me an individualist.
65. I am always involved in lots of activities.
66. I prefer daily assignments to long-range projects in school.
67. I am the leader in my group of friends.
68. People seem to think I make new friends more quickly than most people do.
69. I am even-tempered.
70. I'm troubled by people making fun of me.
71. I do things the best I know how, even if no one checks up on me.
72. I work better with ideas than things.
73. I can usually keep my wits about me even in difficult situations.
74. People consider me very careful about my personal appearance.
75. People seem to think I am easily discouraged when criticized.
76. Philosophy interests me.
77. I am dependable.

Regarding the things I do and the way I do them, this statement describes me:

A. extremely well
B. quite well
C. fairly well
D. slightly
E. not very well

78. Most of my opinions and beliefs are in line with those of everyone else.
79. People seem to think I have good self-control.
80. I like to be told exactly what to do in order to complete an assignment.
81. I think that if something is worth starting it's worth finishing.
82. I seem to know how other people will feel about things.
83. People have criticized me for leaving things undone.
84. Every time something bad happens to me I get so upset I can't think straight.
85. People consider me a non-conformist.
86. I am confident of my ability to meet the demands of school.
87. I tend to be a "deep thinker."
88. I usually organize the activities of my group of friends.
89. People consider me sociable.
90. I seem to be able to influence other people.
91. I am vigorous.
92. I'd rather solve problems on my own than be told the answers.
93. People seem to think my feelings are hurt too easily.
94. I'm more interested in knowing how to apply a theory than why it works.
95. People consider me understanding.
96. I lose interest in most projects before I get them done.
97. Being around strangers makes me ill-at-ease.
98. I can turn out a lot more work than the average person.
99. I'd rather build things than develop theories.
100. I am often self-conscious.
101. People seem to think I lead a vigorous life.
102. People consider me determined.
103. People seem to think my ideas are good and usually join me in what I'm doing.
104. I sympathize with my friends and encourage them when they have problems.
105. I couldn't get along without having people around me most of the time.
106. People seem to think I usually do a good job on whatever I'm doing.
107. I'd rather be with a group of friends than at home by myself.
108. People say I tend to be a "thinker" rather than a "doer."
109. I often prefer reading a good book to going out with other people.
110. I am usually self-controlled.

## APPENDIX F

## THE I/E INVENTORY

## The I/E Student Inventory

Instructions:

This is a questionnaire to find out the way in which certain important events and ideas in our society affect people. As you read each statement, please indicate your agreement or disagreement with it in terms of the key given at the top of the page. People have different reactions to these statements. This is not a test in which there are "right" or "wrong" answers.

In responding to these statements you will notice that there is no way provided for indicating a neutral position. It is desired that you indicate a tendency toward either agreement or disagreement, even though you may prefer to remain undecided.

Your answers to the items in this inventory are to be recorded on a separate answer sheet. Please print your name and other information requested on the answer sheet before you start to respond to the statements. Please answer these statements carefully, but do not spend too much time on any one item. It is important that you respond to every one of the 30 statements.

## The I/E Student Inventory

KEY: A. I strongly agree or accept the statement.
B. I tend to agree or accept the statement.
C. I tend to disagree or reject the statement.
D. I strongly disagree or reject the statement.

1. People who accept life as it is are happier than those who try to change things.
2. Success in life depends more upon ability and effort than upon "getting to know the right people."
3. One of the major reasons we have wars is because most people don't take enough interest in working to prevent them.
4. If a person is not successful in life, it is his own fault.
5. Some people are just born with more talent and ability than others.
6. Trusting to fate usually turns out well for me.
7. A student who "really tries" is usually rewarded for his effort.
8. There will always be conflicts between people, no matter how hard nations work to prevent them.
9. The tougher the job, the harder I work.
10. Heredity is more influential than environment in determining one's personality.
11. I wish teachers would tell me frequently how good my work is.
12. There's not much use in trying too hard to please people; if they like you, they like you.
13. I prefer long-range research projects to daily assigned tasks in school.
14. Many times exam questions tend to be so unrelated to course work that studying is really useless.
15. I would feel more at ease in school if teachers would give me more help and direction in the completion of assignments.
16. Capable people who fail to become successful in life have not taken advantage of their opportunities and abilities.
17. In the long run, good government rests upon the active interest and involvement of each person in the welfare of his community.

18. Most students don't realize the extent to which their grades are influenced by chance

19. People who are lonely just don't try to be friendly.

20. It is very upsetting to have a difficult assignment and not know exactly how to complete it.

21. There is a direct connection between how hard I study and the grades I receive.

22. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

23. It is difficult for the common man to have much control over the things politicians do in office.

24. Unfortunately, a deserving individual often goes unrewarded, no matter how hard he tries.

25. If a student is really well-prepared, there is rarely if ever such a thing as an unfair test.

26. Most of us have very little influence over the direction our lives take.

27. As far as world affairs are concerned, most of us are the victims of forces we cannot control.

28. When I make plans, I can almost always make them work.

29. It is impossible for me to believe that chance or luck plays an important role in my life.

30. Most social problems would be solved if all people really made an effort to do something about them.

# APPENDIX G

# WORD ASSOCIATION TEST

## Word Association Test (Form A)

Listed below are twelve words that have more than one meaning. In the space following each word, you should write down as many of the meanings as you can. The meanings need not be written out in full, writing down one word will usually do. For example:

BARK tree, dog, seal, boat

These four words bring to mind three different meanings for the word BARK: the outer covering of a tree; a certain kind of noise made by some animals like dogs and seals; and a kind of boat. Notice that the meanings were not written out in full, only some words to remind us of these meanings were given. This is all you have to do.

Your score will depend both on the number of different words you write (in the example above this was four) and on the number of different meanings the words remind us of (in the example above this was three). So if you had time to write only two words for BARK, you would choose tree and dog, say, rather than dog and seal because the former words stand for two meanings but the latter words stand for one meaning.

When you are sure of what you are to do, you may begin. You will have approximately 25 minutes.

1. ARM ________________________________________
2. BIT ________________________________________
3. COIL ________________________________________
4. FAIR ________________________________________
5. FILE ________________________________________
6. HOST ________________________________________
7. MORTAR ________________________________________
8. PITCH ________________________________________
9. POKE ________________________________________
10. PUNCH ________________________________________
11. SACK ________________________________________
12. TENDER ________________________________________

# APPENDIX H

# USES FOR THINGS TEST

## Uses For Things Test (Form A)

Listed below are three objects. Your task is to write down as many different uses as you can for each object. Several examples are given in each case. You will have approximately 15 minutes. Be sure to write down some uses for each object. Write down anything that comes to mind, no matter how strange it may seem.

1. BRICKS Build houses, doorstop

2. PENCILS Write, bookmark,

3. PAPER CLIPS Clip paper together, make a necklace

# APPENDIX I

# FRESHMAN PROJECT ACADEMIC INTEREST INVENTORY

## Freshman Project Academic Interest Inventory

To the Student:

On the following pages there are 86 items dealing with various educational activities in different subject-matter areas. You are asked to indicate on a separate answer sheet the degree to which you would be interested in being involved in each. Certainly no one is expected to be equally interested in all school subjects or in all types of school activities.

Your careful answers to the items on this questionnaire will be very useful in the development of better educational techniques suited to your interests. Your answers, however, will be regarded as strictly confidential; and in no way will this form have anything to do with marks or grades in your courses.

The inventory is divided into three parts. Please read the directions at the beginning of each part carefully before proceeding.

## Part I

Directions: The following is a list of activities that you could do if you had some free time during school. For each statement below, mark on the answer sheet: (A) if you would like to do the activity described, (B) if you feel indifferent about doing it, or (C) if you would dislike doing it. Make a firm black mark.

1. Do research on how music affects people.
2. Attend a lecture on the mathematics involved in plotting the course of a rocket or satellite.
3. Listen to and discuss tapes of therapy sessions with a psychologist to learn about different methods of psychotherapy.
4. Find a political problem in the past that parallels one today to compare causes and possible solutions.
5. Go to hear a lecture comparing two books by an author whom you have read and liked.
6. Talk about painting, sculpture and other arts with people who are involved in these fields.
7. Play "WFF 'N Proof" or work on mathematical puzzles or tricks.
8. Read an article about the effects of western civilization on the traditions and customs of the Eskimos.
9. Compare two different theories of heat to find how and why one is better than the other.
10. Find out how slang words get and change their meaning.
11. Read an article about the recent experiments with transplanting limbs and organs.
12. Consult a dictionary to find the meaning of unusual or rarely used words.
13. Find the flaw in a fallacious mathematical proof (for example, one that proves an incorrect statement such as 1=0).
14. Read two articles proposing sharply differing solutions to a problem in urban renewal to find the strengths and weaknesses of each.
15. Try to train rats to solve difficult learning problems.
16. Study and experiment with color combinations.

17. Attend or participate in a poetry reading.

18. Work on writing a poem or short story.

19. Work on a theorem that is "true," but that no one has ever been able to prove.

20. Study the music of a particular composer such as Beethoven.

21. Try to work out plans for a model city.

22. Read about the historical events leading up to a particular political situation you're interested in.

23. Read about new rapid methods of solving arithmetic problems.

24. Make graphs, charts and statistical tables related to some problem you're investigating.

25. Spend time reading and looking at prints to learn to recognize the work of a particular artist such as Rembrandt or Van Gogh.

26. See slides of the effects of radiation on plants and animals and talk to an expert about how these effects are produced.

27. Listen to recordings of two poems and discuss how they arouse different moods.

28. Work out a solution to an imaginary, but possible, dispute between two countries.

29. Mix chemicals to try to make a synthetic material.

30. Play word games.

31. Work on composing a piece of music.

32. Try to work out an interpretation that fits all the parts of a highly symbolic poem.

33. Listen and talk to a lecturer on operating and programming computers.

34. Perform delicate experiments using exact instruments such as a microscope, balance, micrometer, etc. to get the data you want for a study you are doing.

35. Read an article about a new book that has just come out.

36. Construct geometric figures with a ruler, compass and protractor.

37. Get together with a group of students who are interested in a particular book to compare reactions to it.

38. See a movie on the mathematics of billiards and pool.

39. Crossbreed plants to try to develop a particular characteristic in them.

40. Visit a "sleep lab" to see how experiments are done to investigate dreaming and see what has been found from them.

41. Work on a painting.

42. Compare two different poems about the same thing to see which poet's treatment of the subject you like better and why.

43. Spend time thinking up or working with mathematical patterns (like finding the next number in a series).

44. Use the science laboratory to work out an experiment of your own design.

45. Estimate the answer in problems involving size, weight, distance, etc.

46. Meet to discuss and criticize writing you and/or other students have done.

47. Listen to a lecture-discussion on the customs and traditions of a tribal African village.

48. Visit a hospital to watch a brain operation.

49. Try to figure out exactly what elements in a book made you like it.

50. Go on an archeological dig.

51. Conduct experiments to find out the effects of different hormones and drugs on the behavior and development of rats.

52. Observe microscopic life in pond water.

## Part II

Directions: For each statement below, mark on the answer sheet the one of the five choices which best describes how the statement applies to you.

Regarding the things I do and the way to do them, this statement describes me:

A. extremely well
B. quite well
C. fairly well
D. slightly
E. not very well

53. I'd rather compare the literature of two countries than their political systems.

54. I'd rather study and discuss different uses for atomic energy than what our government should do about foreign affairs.

55. I'd rather read about recent developments in the field of music or art than read the reviews of a new book.

56. I get real satisfaction and enjoyment out of working on and solving a difficult math problem.

57. I'd rather write a novel about life in the slums than work with a social work project in a city slum.

58. I'd rather read about how a famous scientist made his discovery than read what a famous philosopher thinks a perfect world would be like.

59. I spend a lot of my free time playing a musical instrument or painting and drawing.

60. In a bookstore or library I'd rather browse through the fiction than the sociology or psychology section.

61. I like to think of ways mathematics can be used.

62. I rarely get really involved in or excited by books about history, sociology, etc.

63. I'm more interested in learning about what causes diseases and how they may be cured than learning about ways to get adequate medical care for the poor.

64. I'd rather talk to my friends about a novel I've just read than talk about political problems.

65. If a math problem is really interesting, I can work on it for hours without getting bored.

66. I'd rather draw the illustrations for a book or article than write it.

67. I'd rather go to a concert than to a meeting to discuss some pressing political problem.

68. I'd rather read an article about mathematical games than read a report of the progress being made in some area of scientific research.

69. I'd rather compare different reviews of a book than compare accounts of the same events in different newspapers.

70. Math seems rather dry to me.

71. I'd rather study the history of the development of research in a particular scientific field than read about the history of events leading to a political problem like the recent Middle East crisis.

72. I'd rather read a novel about the problems a man faces as he grows old than a social-psychology book about the problems of old age in different societies.

73. Aside from books assigned for school, I almost always have a novel I'm reading in my spare time.

74. I'd usually rather listen to a symphony on the radio than read a book.

75. There is rarely a current event or problem that I'm interested in enough to go out of my way to read about it.

76. I'd rather read an article on a theory about the origin of the earth than a theory dealing with the beginning of civilization.

## Part III

Directions: Read the possible responses to each item and find the one that best completes the sentence for you. Then blacken the space in the column on the answer sheet corresponding to the letter of the answer you select.

77. Which of the following would you rather do:
    a. Win a Pulitzer Prize (literature award)
    b. Be the first to prove a mathematical theorem that people have been trying to prove for years
    c. Win a Nobel Prize for scientific research
    d. Win the Nobel Peace Prize
    e. Receive international acclaim for an artistic creation or performance.

78. Suppose you were on an expedition that discovered the ruins of an ancient civilization. Which of the following would you be most interested in finding out about:
    a. The literature and language of the people.
    b. The mathematics they used.
    c. The art and music of the civilization.
    d. The social organization and customs of the civilization.
    e. The level of scientific advancement the people reached.

79. If you were to join a club, would you rather join one that:
    a. Discussed political problems.
    b. Discussed current trends of the arts in America.
    c. Discussed new books.
    d. Studied stars and planets.
    e. Discussed the use of mathematics in logic.

80. Which of the following would you rather be:
   a. A drama critic
   b. A research chemist.
   c. A psychologist.
   d. A mathematician in computer design and research.
   e. A musician in a band or orchestra.

81. If you had the opportunity and necessary background, which would you rather spend a summer doing:
   a. Working renovating Italian Art.
   b. Working in a lab doing research on the causes of heart disease.
   c. Studying life in a different culture by living in an Indian village.
   d. Working on the editorial staff of a literary magazine.
   e. Being part of a project working on the mathematics involved in the plotting of a course for a rocket or satellite.

82. If you were on a project designing the plans for a model city, which of the following would you rather do:
   a. Work on the statistics involved in the problems of overpopulation, taxes, distribution of goods, etc.
   b. Consider the possibilities of using atomic energy to control the city's temperature, rainfall and climate.
   c. Work on the architectual and artistic design of a model city.
   d. Make plans for dealing with such possible problems as racial integration and poverty.
   e. Work on the literary facilities for the city -- selecting the books for the library, working out plans for and/or writing a literary magazine, etc.

83. Which would you rather do:
   a. Develop a very original solution for a problem in mathematical logic.
   b. Come up with a new way to approach a problem in science and make plans for all the necessary procedures and equipment.
   c. Come up with an original interpretation for a poem.
   d. Compose a piece of music.
   e. Work out an original explanation for a particular historical or sociological phenomenon (like the decline and fall of the Roman Empire or why man expresses a need for religion).

84. If you were to take a position in industry, which of the following would you do:
   a. Work on the development and testing of new products.
   b. Work with the mathematics involved in distribution, supply and demand, or the math needed for designing research programs.
   c. Work on employee-management relations, working conditions, unions, etc.
   d. Do the design for advertising.
   e. Be in charge of writing descriptions of the firm's products, research, problems etc. for magazines, newspapers or other publications.

85. Which of the following books would you rather read:
   a. *Mathematical Probabilities of Gambling*
   b. *Dr. Zhivago*
   c. *Changing Social Customs and Mores in America*
   d. *Problems and Possibilities for Interplanetary Travel*
   e. *Innovations in Modern Art and Music*

86. If you had a chance to see and study the original and very early works of one of the following men which would you choose:
   a. Newton
   b. Pythagoras
   c. Mozart
   d. Marx
   e. Shakespeare

# APPENDIX J

# OPTION CODING FORM

## OPTION CODING FORM

| | Remedial | Review | Development | Enrichment | Undifferentiated |
|---|---|---|---|---|---|
| Teacher-led lecture, discussion, etc. | 1 | 2 | 3 | 4 | 5 |
| Student-led lecture, play, discussion, etc. | 6 | 7 | 8 | 9 | 10 |
| Outside speaker, lecture, discussion, etc. | 11 | 12 | 13 | 14 | 15 |
| A-V presentation | 16 | 17 | 18 | 19 | 20 |
| Student-teacher Conference | 21 | 22 | 23 | 24 | 25 |
| Students in group study | 26 | 27 | 28 | 29 | 30 |
| Students in silent study | 31 | 32 | 33 | 34 | 35 |
| Field trip | 36 | 37 | 38 | 39 | 40 |
| Lab work | 41 | 42 | 43 | 44 | 45 |
| Library | 46 | 47 | 48 | 49 | 50 |

Date: ______________________ Period: __________ Teacher: ____________________

Fill out a separate form for each option you give by placing a check in the appropriate square. If you are unable to code any given option write a short explanation below.

# APPENDIX K

# TEACHER INDEPENDENCE RATINGS

To: ALL FRESHMAN PROJECT TEACHERS

In re: RESEARCH AND DATA COLLECTION

In order to continue Freshman Project assessment of student self-report data in comparison with teacher-ratings for independence, may we ask you to provide a pair of numerical independence ratings for each of your students.

Please respond to the question: "To what extent has ______________ learned to take responsibility for the direction of his own learning activities from the beginning of the school year to the present time?" Indicate each student's growth in independence by providing two Likert Scale scores for each pupil -- an "initial" independence indication in Column 1 and a "present" level of independence in Column 2. Base each score upon the following scale:

1- Very low
2- Low
3- Average
4- High
5- Very high

A list of all Freshman students is enclosed. Please provide scores only for those students who are enrolled in your classes.

Thank you once again for your patience and effort.

| Student Name | Initial Level of Independence | Present Level of Independence |
|---|---|---|
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# APPENDIX L

## RESEARCH TABLES 1 - 19

## TABLE I

## NAMES AND NUMBERS OF VARIABLES STUDIED IN THE FRESHMAN PROJECT, 1967-68

| Variable Name | Number |
|---|---|
| Age (in Months) | 1 |
| IQ (Henmon-Nelson) | 2 |
| STEP Writing -pre-test | 3 |
| STEP Social Studies -pre-test | 4 |
| STEP Mathematics - pre-test | 5 |
| STEP Science - pre-test | 6 |
| Cooperative Reading - pre-test | 7 |
| Years in Attendance in the Lab School | 8 |
| Sex (1 for boys, 2 for girls) | 9 |
| Group (1 for group A, 2 for group B) | 10 |
| Word Association Test for Creativity - pre-test | 11 |
| Uses for Things Test for Creativity - pre-test | 12 |
| Estimated Lab School Reading Level | 13 |
| Test on Understanding Science - pre-test | 14 |
| STEP Writing - post-test | 15 |
| STEP Social Studies - post-test | 16 |
| STEP Mathematics - post-test | 17 |
| STEP Science -post-test | 18 |
| Cooperative Reading - post-test | 19 |
| Final Grade in English | 20 |
| Final Grade in Social Studies | 21 |
| Final Grade in Mathematics | 22 |
| Final Grade in Science | 23 |
| Bernstein Q-Sort - Pre-Y Test | 24 |
| Bernstein Q-Sort - Pre-T test | 25 |
| Bernstein Q-Sort - Pre Y/T Ratio | 26 |
| Bernstein Q-Sort - Post- Y Test | 27 |
| Bernstein Q-Sort - Post- T Test | 28 |
| Bernstein Q-Sort - Post Y/T Ratio | 29 |
| Student Independence Rating - English | 30 |
| Student Independence Rating - Social Studies | 31 |
| Student Independence Rating - Mathematics | 32 |
| Student Independence Rating - Science | 33 |
| I/E Inventory | 34 |
| Need for Structure | 35 |
| Uses for Things Test for Creativity - post-test | 36 |
| Word Association Test for Creativity - post-test | 37 |
| Percent of Option Time Spent in English | 38 |
| Percent of Option Time Spent in Social Studies | 39 |
| Percent of Option Time Spent in Science | 40 |
| Percent of Option Time Spent in Mathematics | 41 |
| Percent of Option Time Spent in all Study Activities | 42 |

Percent of Option Time Spent in the Library 43
Percent of Option Time Spent in Study Hall 44
Percent of Option Time Spent in the Cafeteria 45
Percent of Option Time Spent in Teacher-Led Activities 46
Percent of Option Time Spent in Student-Led Activities 47
Percent of Option Time Spent in Audio-Visual Activities 48
Percent of Option Time Spent in Student-Teacher Conferences 49
Percent of Option Time Spent in Remedial or Review Activities 50
Percent of Option Time Spent in Developmental Activities 51
Percent of Option Time Spent in Enrichment Activities 52
Interest Inventory Score - Social Studies 53
Interest Inventory Score - Science 54
Interest Inventory Score - Mathematics 55
Interest Inventory Score - English 56
Interest Inventory Score - The Arts 57
Student Inventory Score - Self-Directedness 58
Student Inventory Score - Self-Confidence 57
Student Inventory Score - Diligence 60
Student Inventory Score - Theoreticality 61
Student Inventory Score - Leadership 62
Student Inventory Score - Sociability 63
Student Inventory Score - Enthusiasm 64
Student Inventory Score - Poise 65
Student Inventory Score - Individualism 66
Student Inventory - Sociability Factor 67
Student Inventory - Diligence Factor 68
Student Inventory - Individualism Factor 69
Student Inventory Total 70
Library Skills Test - pre-test 71
Science I -pre-test 72
Social Studies Survey -pre-test 73

## TABLE 2

## MEANS AND STANDARD DEVIATIONS FOR VARIABLES STUDIED IN THE FRESHMAN PROJECT, 1967-68

| Variable Number | N | Mean | Std. Deviation |
|---|---|---|---|
| 1 | 162 | 13.48 | 11.98 |
| 2 | 162 | 126.18 | 14.51 |
| 3 | 162 | 289.80 | 14.91 |
| 4 | 162 | 286.17 | 15.79 |
| 5 | 162 | 280.15 | 13.09 |
| 6 | 162 | 286.22 | 11.88 |
| 7 | 162 | 156.44 | 7.39 |
| 8 | 162 | 3.09 | 2.97 |
| 9 | 162 | 1.47 | 0.50 |
| 10 | 162 | 1.50 | 0.50 |
| 11 | 162 | 48.41 | 8.73 |
| 12 | 162 | 23.18 | 8.15 |
| 13 | 162 | 8.90 | 1.67 |
| 14 | 162 | 26.00 | 4.90 |
| 15 | 162 | 298.44 | 15.21 |
| 16 | 162 | 286.51 | 11.58 |
| 17 | 162 | 285.32 | 12.27 |
| 18 | 162 | 286.51 | 10.46 |
| 19 | 162 | 159.46 | 7.14 |
| 20 | 162 | 3.14 | 0.93 |
| 21 | 162 | 2.75 | 0.90 |
| 22 | 162 | 2.52 | 1.24 |
| 23 | 162 | 2.84 | 0.91 |
| 24 | 162 | 77.53 | 7.26 |
| 25 | 162 | 77.92 | 8.58 |
| 26 | 162 | 100.38 | 12.78 |
| 27 | 162 | 80.91 | 9.32 |
| 28 | 162 | 79.67 | 10.28 |
| 29 | 162 | 103.28 | 18.53 |
| 30 | 162 | 6.12 | 2.23 |
| 31 | 162 | 5.72 | 2.15 |
| 32 | 162 | 5.84 | 1.87 |
| 33 | 162 | 6.14 | 1.77 |
| 34 | 162 | 17.03 | 3.21 |
| 35 | 162 | 0.67 | 0.47 |
| 36 | 162 | 26.99 | 11.87 |
| 37 | 162 | 61.25 | 12.90 |
| 38 | 162 | 15.64 | 15.01 |
| 39 | 162 | 13.40 | 13.67 |
| 40 | 162 | 11.72 | 11.44 |
| 41 | 162 | 3.21 | 5.36 |
| 42 | 162 | 47.42 | 22.40 |

TABLE 2 (Cont'd)

| Variable Number | N | Mean | Std. Deviation |
|---|---|---|---|
| 43 | 162 | 34.02 | 21.25 |
| 44 | 162 | 4.09 | 7.59 |
| 45 | 162 | 9.31 | 18.83 |
| 46 | 162 | 11.41 | 8.07 |
| 47 | 162 | 9.15 | 10.26 |
| 48 | 162 | 12.60 | 11.12 |
| 49 | 162 | 13.32 | 12.03 |
| 50 | 162 | 3.71 | 5.37 |
| 51 | 162 | 15.06 | 12.64 |
| 52 | 162 | 29.45 | 18.39 |
| 53 | 162 | 16.86 | 5.00 |
| 54 | 162 | 15.09 | 5.34 |
| 55 | 162 | 11.92 | 5.45 |
| 56 | 162 | 15.20 | 4.85 |
| 57 | 162 | 7.11 | 5.52 |
| 58 | 162 | 6.19 | 2.28 |
| 59 | 162 | 4.41 | 2.32 |
| 60 | 162 | 8.12 | 4.57 |
| 61 | 162 | 4.05 | 2.27 |
| 62 | 162 | 2.91 | 1.89 |
| 63 | 162 | 9.49 | 4.01 |
| 64 | 162 | 3.87 | 2.22 |
| 65 | 162 | 5.32 | 2.47 |
| 66 | 162 | 3.99 | 2.22 |
| 67 | 162 | 21.61 | 7.60 |
| 68 | 162 | 18.75 | 7.01 |
| 69 | 162 | 7.98 | 3.85 |
| 70 | 162 | 48.35 | 13.53 |
| 71 | 162 | 18.88 | 4.90 |
| 72 | 162 | 39.03 | 11.66 |
| 73 | 162 | 37.70 | 7.32 |

## TABLE 3

Zero-Order Correlations Among Variables Studied in the Freshman Project, 1967-68

| Correlation Coefficients | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | | | | | | | | | | | | |
| 2 | 0.552 | 1.000 | | | | | | | | | | | |
| 3 | -0.090 | 0.233 | 1.000 | | | | | | | | | | |
| 4 | 0.018 | 0.356 | 0.357 | 1.000 | | | | | | | | | |
| 5 | -0.037 | 0.310 | 0.233 | 0.494 | 1.000 | | | | | | | | |
| 6 | 0.004 | 0.259 | 0.175 | 0.506 | 0.482 | 1.000 | | | | | | | |
| 7 | -0.060 | 0.427 | 0.440 | 0.589 | 0.464 | 0.447 | 1.000 | | | | | | |
| 8 | -0.085 | -0.121 | -0.246 | -0.315 | -0.304 | -0.177 | -0.274 | 1.000 | | | | | |
| 9 | -0.094 | -0.136 | 0.017 | -0.195 | -0.251 | -0.312 | 0.021 | 0.169 | 1.000 | | | | |
| 10 | 0.097 | 0.013 | 0.133 | -0.022 | -0.059 | 0.018 | 0.044 | -0.054 | 0.049 | 1.000 | | | |
| 11 | -0.021 | 0.209 | 0.233 | 0.259 | 0.167 | 0.160 | 0.399 | -0.056 | -0.010 | 0.079 | 1.000 | | |
| 12 | 0.012 | 0.095 | 0.269 | 0.071 | -0.011 | 0.039 | 0.250 | 0.017 | 0.189 | 0.221 | 0.423 | 1.000 | |
| 13 | 0.021 | 0.432 | 0.397 | 0.509 | 0.364 | 0.434 | 0.861 | -0.163 | 0.041 | 0.096 | 0.425 | 0.298 | 1.000 |
| 14 | -0.076 | 0.161 | 0.276 | 0.376 | 0.357 | 0.296 | 0.526 | -0.070 | 0.035 | 0.164 | 0.290 | 0.262 | 0.520 |
| 15 | -0.082 | 0.258 | 0.576 | 0.469 | 0.381 | 0.279 | 0.568 | -0.147 | 0.268 | 0.060 | 0.280 | 0.342 | 0.550 |
| 16 | 0.016 | 0.377 | 0.346 | 0.693 | 0.544 | 0.535 | 0.668 | -0.305 | -0.233 | 0.014 | 0.365 | 0.189 | 0.600 |
| 17 | -0.032 | 0.356 | 0.265 | 0.474 | 0.653 | 0.441 | 0.435 | -0.166 | -0.365 | 0.001 | 0.258 | 0.046 | 0.440 |
| 18 | 0.008 | 0.315 | 0.236 | 0.496 | 0.480 | 0.691 | 0.520 | -0.194 | -0.254 | 0.062 | 0.244 | 0.115 | 0.620 |
| 19 | -0.072 | 0.414 | 0.358 | 0.604 | 0.422 | 0.481 | 0.799 | -0.132 | 0.090 | 0.000 | 0.404 | 0.240 | 0.768 |
| 20 | -0.024 | 0.126 | 0.345 | 0.233 | 0.186 | 0.133 | 0.432 | -0.110 | 0.203 | -0.047 | 0.170 | 0.191 | 0.335 |
| 21 | 0.120 | 0.242 | 0.280 | 0.268 | 0.207 | 0.234 | 0.391 | -0.094 | 0.127 | 0.241 | 0.279 | 0.318 | 0.320 |
| 22 | -0.085 | 0.248 | 0.306 | 0.445 | 0.416 | 0.418 | 0.484 | -0.153 | 0.016 | 0.010 | 0.301 | 0.215 | 0.485 |
| 23 | -0.103 | 0.187 | 0.289 | 0.300 | 0.343 | 0.297 | 0.393 | -0.089 | -0.025 | -0.054 | 0.249 | 0.142 | 0.396 |
| 24 | -0.043 | -0.081 | -0.201 | 0.002 | 0.137 | 0.169 | 0.063 | 0.015 | -0.076 | 0.080 | -0.034 | -0.018 | 0.040 |
| 25 | -0.037 | 0.084 | -0.061 | -0.043 | 0.074 | 0.033 | 0.032 | -0.044 | -0.009 | 0.031 | 0.070 | 0.069 | 0.007 |
| 26 | 0.006 | -0.121 | 0.044 | 0.038 | 0.042 | 0.075 | 0.008 | 0.031 | -0.046 | 0.025 | -0.119 | -0.075 | 0.007 |
| 27 | 0.000 | 0.071 | 0.108 | 0.101 | 0.126 | 0.008 | 0.110 | -0.027 | 0.003 | 0.059 | 0.005 | 0.033 | 0.095 |
| 28 | -0.007 | 0.054 | -0.063 | -0.041 | 0.068 | -0.037 | -0.014 | -0.042 | 0.074 | -0.114 | -0.008 | 0.028 | -0.015 |
| 29 | 0.027 | 0.009 | 0.111 | 0.115 | 0.050 | 0.027 | 0.091 | 0.017 | -0.078 | 0.135 | 0.020 | -0.024 | 0.098 |
| 30 | -0.056 | 0.113 | 0.369 | 0.248 | 0.158 | 0.122 | 0.404 | -0.114 | 0.184 | 0.297 | 0.287 | 0.282 | 0.368 |
| 31 | 0.039 | 0.202 | 0.265 | 0.231 | 0.183 | 0.166 | 0.367 | -0.061 | 0.029 | 0.429 | 0.215 | 0.220 | 0.382 |
| 32 | 0.009 | 0.190 | 0.280 | 0.196 | 0.192 | 0.181 | 0.347 | -0.188 | 0.107 | 0.192 | 0.238 | 0.135 | 0.300 |
| 33 | -0.056 | 0.206 | 0.296 | 0.376 | 0.369 | 0.299 | 0.445 | -0.126 | -0.090 | 0.045 | 0.256 | 0.128 | 0.376 |
| 34 | 0.016 | 0.075 | -0.027 | 0.094 | 0.168 | 0.216 | 0.201 | -0.127 | 0.014 | -0.091 | 0.089 | 0.018 | 0.223 |
| 35 | -0.092 | -0.056 | -0.097 | -0.020 | -0.039 | -0.010 | -0.095 | 0.064 | 0.008 | -0.131 | -0.209 | -0.123 | -0.139 |
| 36 | -0.070 | 0.082 | 0.280 | 0.215 | 0.064 | 0.067 | 0.292 | -0.005 | 0.215 | 0.211 | 0.346 | 0.560 | 0.331 |

TABLE 3 Continued

| Correlation Coefficients | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 0.015 | 0.288 | 0.216 | 0.324 | 0.140 | 0.193 | 0.362 | -0.020 | -0.019 | 0.222 | 0.502 | 0.393 | 0.385 |
| 38 | -0.156 | 0.003 | 0.106 | 0.008 | -0.010 | 0.140 | -0.016 | 0.062 | -0.116 | 0.159 | 0.009 | -0.021 | 0.129 |
| 39 | 0.057 | 0.193 | -0.048 | 0.253 | 0.188 | 0.210 | 0.224 | -0.075 | -0.216 | -0.094 | 0.157 | 0.034 | 0.182 |
| 40 | -0.014 | 0.021 | -0.053 | 0.043 | 0.128 | 0.114 | 0.000 | 0.016 | -0.127 | -0.020 | 0.036 | -0.100 | 0.017 |
| 41 | 0.026 | -0.049 | -0.102 | -0.010 | -0.065 | -0.065 | -0.107 | -0.020 | -0.057 | 0.119 | 0.064 | 0.024 | -0.086 |
| 42 | 0.041 | -0.124 | -0.005 | -0.240 | -0.082 | -0.151 | -0.186 | 0.063 | 0.057 | 0.111 | -0.130 | -0.012 | -0.185 |
| 43 | 0.037 | -0.107 | 0.037 | -0.145 | 0.023 | -0.101 | 0.017 | 0.015 | 0.171 | 0.150 | -0.017 | 0.101 | -0.011 |
| 44 | 0.014 | -0.035 | 0.045 | 0.030 | -0.001 | -0.045 | -0.108 | -0.054 | -0.188 | 0.233 | 0.087 | -0.012 | -0.053 |
| 45 | 0.002 | -0.013 | -0.067 | -0.134 | -0.123 | -0.049 | -0.196 | 0.080 | -0.049 | -0.131 | -0.171 | -0.124 | -0.187 |
| 46 | -0.031 | -0.028 | -0.217 | 0.106 | 0.073 | 0.032 | 0.010 | 0.102 | -0.061 | 0.163 | 0.027 | -0.048 | 0.021 |
| 47 | 0.021 | 0.091 | 0.107 | 0.074 | 0.032 | 0.010 | 0.102 | -0.061 | -0.086 | -0.143 | 0.040 | -0.010 | 0.109 |
| 48 | 0.018 | 0.084 | 0.034 | 0.076 | -0.092 | 0.043 | 0.047 | 0.075 | 0.071 | 0.061 | 0.031 | 0.132 | 0.057 |
| 49 | -0.033 | 0.048 | 0.022 | 0.104 | 0.127 | 0.139 | 0.124 | -0.077 | -0.010 | 0.092 | 0.105 | -0.037 | 0.131 |
| 50 | 0.046 | -0.120 | -0.121 | -0.058 | -0.208 | -0.104 | -0.133 | 0.061 | -0.013 | 0.214 | 0.001 | 0.046 | -0.089 |
| 51 | -0.112 | 0.050 | 0.023 | 0.143 | 0.099 | 0.147 | 0.130 | -0.054 | -0.157 | 0.130 | 0.091 | 0.067 | 0.161 |
| 52 | 0.029 | 0.150 | -0.004 | 0.151 | 0.043 | 0.108 | 0.123 | -0.017 | -0.002 | -0.259 | 0.047 | 0.006 | 0.092 |
| 53 | 0.061 | 0.225 | 0.154 | 0.343 | 0.182 | 0.075 | 0.292 | -0.220 | 0.011 | 0.002 | 0.056 | 0.023 | 0.215 |
| 54 | -0.040 | -0.025 | 0.030 | 0.014 | 0.161 | 0.187 | 0.055 | -0.126 | -0.491 | -0.022 | 0.045 | -0.024 | -0.080 |
| 55 | -0.049 | 0.093 | 0.038 | 0.075 | 0.189 | 0.161 | 0.078 | 0.041 | -0.332 | -0.023 | 0.050 | 0.033 | 0.030 |
| 56 | -0.024 | 0.016 | 0.170 | 0.018 | -0.140 | -0.131 | 0.146 | 0.087 | 0.461 | 0.099 | 0.079 | 0.115 | 0.175 |
| 57 | -0.123 | -0.073 | 0.070 | -0.071 | -0.141 | -0.200 | 0.007 | -0.031 | 0.150 | 0.117 | 0.056 | 0.144 | -0.059 |
| 58 | -0.085 | 0.077 | 0.186 | 0.203 | 0.183 | 0.161 | 0.345 | -0.077 | -0.057 | 0.046 | 0.392 | 0.147 | 0.277 |
| 59 | -0.194 | -0.107 | 0.033 | 0.091 | 0.147 | 0.071 | 0.106 | -0.058 | -0.093 | 0.035 | 0.127 | -0.049 | 0.025 |
| 60 | -0.062 | 0.060 | 0.114 | 0.180 | 0.072 | 0.050 | 0.181 | -0.074 | 0.025 | 0.031 | 0.168 | 0.113 | 0.121 |
| 61 | -0.055 | 0.241 | 0.111 | 0.211 | 0.129 | 0.143 | 0.271 | 0.066 | -0.086 | 0.076 | 0.148 | 0.181 | 0.259 |
| 62 | 0.030 | -0.016 | -0.063 | -0.022 | -0.028 | 0.062 | 0.005 | -0.099 | -0.171 | -0.042 | 0.089 | 0.012 | -0.011 |
| 63 | -0.044 | -0.162 | 0.061 | -0.158 | -0.183 | -0.159 | -0.063 | 0.003 | 0.079 | 0.170 | -0.043 | -0.049 | -0.114 |
| 64 | -0.046 | -0.072 | -0.002 | -0.061 | -0.086 | -0.076 | 0.008 | 0.034 | -0.068 | 0.059 | 0.041 | 0.099 | -0.062 |
| 65 | -0.149 | -0.080 | -0.027 | 0.069 | 0.090 | 0.138 | 0.079 | -0.034 | -0.122 | 0.105 | 0.043 | -0.002 | 0.050 |
| 66 | -0.122 | 0.062 | 0.059 | 0.150 | 0.178 | 0.165 | 0.213 | -0.040 | 0.115 | -0.025 | 0.099 | -0.004 | 0.181 |
| 67 | -0.076 | -0.135 | 0.007 | -0.083 | -0.095 | -0.044 | -0.001 | -0.027 | -0.063 | 0.132 | 0.025 | 0.005 | -0.063 |
| 68 | -0.131 | 0.036 | 0.151 | 0.222 | 0.168 | 0.111 | 0.275 | -0.105 | -0.036 | 0.056 | 0.280 | 0.108 | 0.183 |
| 69 | -0.111 | 0.166 | 0.010 | 0.200 | 0.151 | 0.164 | 0.265 | 0.032 | -0.102 | 0.014 | 0.146 | 0.111 | 0.246 |
| 70 | -0.142 | -0.010 | 0.111 | 0.125 | 0.077 | 0.080 | 0.217 | -0.060 | -0.083 | 0.108 | 0.201 | 0.090 | 0.129 |
| 71 | -0.032 | 0.288 | 0.324 | 0.417 | 0.403 | 0.295 | 0.515 | -0.181 | -0.005 | -0.044 | 0.144 | 0.018 | 0.449 |
| 72 | -0.062 | 0.242 | 0.155 | 0.290 | 0.460 | 0.440 | 0.463 | -0.094 | -0.262 | -0.395 | 0.181 | -0.026 | 0.387 |
| 73 | 0.005 | 0.319 | 0.308 | 0.447 | 0.398 | 0.398 | 0.647 | -0.224 | -0.154 | -0.079 | 0.274 | 0.135 | 0.596 |

TABLE 3 Continued

| Correlation Coefficients | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 1.000 | | | | | | | | | | | | |
| 15 | 0.379 | 1.000 | | | | | | | | | | | |
| 16 | 0.492 | 0.510 | 1.000 | | | | | | | | | | |
| 17 | 0.338 | 0.316 | 0.615 | 1.000 | | | | | | | | | |
| 18 | 0.376 | 0.387 | 0.617 | 0.506 | 1.000 | | | | | | | | |
| 19 | 0.528 | 0.592 | 0.663 | 0.453 | 0.607 | 1.000 | | | | | | | |
| 20 | 0.385 | 0.563 | 0.366 | 0.179 | 0.226 | 0.363 | 1.000 | | | | | | |
| 21 | 0.370 | 0.458 | 0.394 | 0.157 | 0.309 | 0.346 | 0.606 | 1.000 | | | | | |
| 22 | 0.391 | 0.550 | 0.554 | 0.472 | 0.470 | 0.512 | 0.537 | 0.512 | 1.000 | | | | |
| 23 | 0.249 | 0.142 | 0.361 | 0.320 | 0.465 | 0.495 | 0.394 | 0.593 | 0.655 | 1.000 | | | |
| 24 | 0.085 | 0.000 | 0.056 | 0.141 | 0.162 | 0.058 | 0.022 | -0.019 | -0.017 | 0.053 | 1.000 | | |
| 25 | -0.059 | -0.004 | -0.025 | 0.046 | 0.050 | 0.014 | -0.030 | 0.042 | 0.036 | 0.012 | 0.290 | 1.000 | |
| 26 | 0.090 | 0.006 | 0.063 | 0.072 | 0.067 | 0.014 | 0.047 | -0.069 | -0.056 | 0.029 | 0.463 | -0.675 | 1.000 |
| 27 | 0.238 | 0.173 | 0.112 | 0.191 | 0.065 | 0.151 | 0.162 | 0.144 | 0.152 | 0.124 | 0.368 | 0.157 | 0.128 |
| 28 | -0.025 | 0.014 | -0.069 | 0.080 | -0.009 | -0.023 | -0.053 | -0.037 | -0.003 | 0.020 | 0.147 | 0.444 | -0.297 |
| 29 | 0.183 | 0.075 | 0.137 | 0.087 | 0.058 | 0.110 | 0.151 | 0.105 | 0.095 | 0.043 | 0.151 | -0.252 | 0.358 |
| 30 | 0.333 | 0.483 | 0.330 | 0.172 | 0.209 | 0.309 | 0.638 | 0.575 | 0.344 | 0.505 | 0.051 | -0.025 | 0.069 |
| 31 | 0.288 | 0.399 | 0.367 | 0.157 | 0.252 | 0.293 | 0.562 | 0.682 | 0.352 | 0.487 | 0.051 | 0.029 | 0.020 |
| 32 | 0.298 | 0.466 | 0.288 | 0.120 | 0.256 | 0.337 | 0.587 | 0.536 | 0.410 | 0.538 | 0.066 | -0.038 | 0.017 |
| 33 | 0.375 | 0.478 | 0.481 | 0.319 | 0.359 | 0.401 | 0.666 | 0.537 | 0.506 | 0.642 | 0.090 | 0.038 | 0.017 |
| 34 | 0.098 | 0.123 | 0.162 | 0.045 | 0.223 | 0.214 | 0.167 | 0.099 | 0.128 | 0.167 | 0.037 | -0.060 | 0.095 |
| 35 | -0.209 | -0.145 | -0.108 | 0.019 | 0.000 | -0.080 | -0.146 | -0.170 | -0.074 | -0.125 | 0.021 | -0.143 | 0.149 |
| 36 | 0.252 | 0.413 | 0.266 | 0.153 | 0.198 | 0.334 | 0.274 | 0.292 | 0.307 | 0.308 | -0.086 | 0.075 | -0.129 |
| 37 | 0.183 | 0.357 | 0.402 | 0.269 | 0.333 | 0.377 | 0.267 | 0.378 | 0.322 | 0.360 | -0.057 | 0.164 | -0.185 |
| 38 | -0.068 | 0.075 | 0.009 | -0.031 | 0.026 | 0.113 | -0.018 | -0.072 | 0.017 | 0.024 | 0.016 | -0.003 | 0.037 |
| 39 | 0.180 | 0.033 | 0.284 | 0.152 | 0.146 | 0.102 | 0.176 | 0.315 | 0.238 | 0.277 | -0.050 | 0.007 | -0.029 |
| 40 | 0.011 | 0.049 | 0.043 | 0.121 | 0.110 | 0.023 | 0.140 | 0.037 | 0.195 | 0.246 | 0.084 | 0.037 | 0.026 |
| 41 | -0.081 | -0.041 | 0.007 | -0.037 | 0.068 | 0.009 | -0.009 | 0.006 | 0.053 | 0.124 | -0.055 | 0.022 | -0.044 |
| 42 | -0.032 | -0.117 | -0.165 | -0.035 | -0.183 | -0.174 | -0.143 | -0.183 | -0.268 | -0.295 | 0.072 | -0.021 | 0.034 |
| 43 | 0.091 | 0.066 | 0.003 | -0.009 | -0.091 | -0.010 | 0.132 | 0.078 | 0.044 | 0.000 | -0.016 | -0.070 | 0.066 |
| 44 | 0.036 | 0.004 | 0.065 | 0.162 | 0.006 | -0.118 | 0.013 | -0.029 | -0.035 | 0.007 | 0.134 | 0.068 | 0.043 |
| 45 | -0.155 | -0.216 | -0.225 | -0.097 | -0.118 | -0.147 | -0.324 | -0.294 | -0.353 | -0.354 | 0.049 | 0.028 | -0.051 |
| 46 | -0.059 | -0.109 | 0.065 | -0.019 | 0.057 | 0.052 | 0.039 | 0.006 | 0.051 | 0.153 | -0.016 | -0.008 | -0.003 |
| 47 | -0.090 | 0.027 | -0.007 | -0.015 | 0.063 | 0.022 | 0.021 | -0.028 | 0.019 | 0.004 | 0.007 | 0.049 | -0.019 |
| 48 | 0.021 | 0.011 | 0.032 | -0.085 | -0.014 | 0.012 | -0.023 | 0.155 | 0.016 | 0.006 | -0.256 | -0.256 | -0.065 |
| 49 | 0.118 | 0.137 | 0.135 | 0.104 | 0.207 | 0.138 | 0.169 | 0.138 | 0.258 | 0.286 | 0.125 | 0.117 | 0.019 |

TABLE 3 Continued

| Correlation Coefficients | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | -0.037 | -0.099 | -0.051 | -0.110 | 0.058 | -0.034 | -0.068 | 0.013 | -0.064 | 0.057 | -0.002 | 0.031 | -0.069 |
| 51 | 0.158 | 0.092 | 0.166 | 0.132 | 0.216 | 0.132 | 0.149 | 0.143 | 0.321 | 0.304 | 0.054 | 0.036 | 0.010 |
| 52 | -0.065 | 0.048 | 0.062 | -0.030 | 0.045 | 0.075 | 0.030 | 0.066 | 0.074 | 0.067 | -0.130 | -0.004 | -0.036 |
| 53 | 0.186 | 0.255 | 0.409 | 0.149 | 0.124 | 0.247 | 0.119 | 0.197 | 0.136 | 0.114 | 0.070 | 0.047 | 0.015 |
| 54 | 0.023 | -0.153 | 0.057 | 0.098 | 0.164 | -0.113 | -0.029 | -0.082 | -0.050 | 0.028 | 0.101 | 0.074 | -0.015 |
| 55 | 0.048 | -0.034 | 0.113 | 0.327 | 0.173 | -0.036 | 0.043 | -0.076 | 0.098 | 0.073 | 0.074 | 0.155 | -0.078 |
| 56 | -0.063 | 0.197 | -0.111 | -0.183 | -0.190 | 0.131 | 0.115 | 0.107 | -0.019 | -0.028 | -0.079 | -0.035 | -0.063 |
| 57 | -0.067 | -0.000 | -0.086 | -0.151 | -0.156 | -0.110 | 0.045 | -0.023 | -0.054 | -0.083 | -0.091 | -0.018 | -0.035 |
| 58 | 0.172 | 0.178 | 0.324 | 0.267 | 0.267 | 0.260 | 0.253 | 0.214 | 0.153 | 0.295 | 0.139 | 0.097 | 0.002 |
| 59 | 0.100 | 0.100 | 0.157 | 0.260 | 0.084 | 0.100 | 0.091 | -0.080 | 0.149 | 0.087 | 0.112 | 0.136 | -0.034 |
| 60 | 0.068 | 0.188 | 0.154 | 0.086 | 0.067 | 0.124 | 0.339 | 0.357 | 0.240 | 0.385 | 0.025 | 0.184 | -0.164 |
| 61 | 0.196 | 0.133 | 0.202 | 0.208 | 0.140 | 0.204 | 0.061 | 0.131 | 0.088 | 0.043 | 0.044 | 0.016 | 0.010 |
| 62 | 0.052 | -0.152 | 0.047 | 0.084 | 0.076 | -0.039 | -0.067 | 0.045 | -0.109 | -0.012 | -0.078 | -0.004 | -0.043 |
| 63 | -0.068 | -0.108 | -0.161 | -0.083 | -0.163 | -0.168 | 0.094 | 0.067 | -0.048 | 0.003 | -0.037 | -0.065 | 0.013 |
| 64 | -0.035 | -0.117 | -0.083 | 0.086 | -0.081 | -0.060 | 0.081 | 0.095 | 0.035 | 0.078 | -0.037 | -0.004 | 0.085 |
| 65 | 0.107 | -0.047 | -0.141 | 0.082 | 0.144 | 0.016 | -0.001 | 0.012 | 0.038 | 0.028 | 0.019 | 0.033 | -0.017 |
| 66 | 0.176 | 0.031 | 0.156 | 0.249 | 0.163 | 0.191 | -0.042 | 0.005 | 0.053 | -0.016 | 0.154 | -0.011 | 0.142 |
| 67 | 0.004 | -0.146 | -0.050 | 0.033 | -0.041 | -0.109 | 0.056 | 0.076 | -0.082 | 0.029 | -0.041 | -0.052 | 0.015 |
| 68 | 0.143 | 0.216 | 0.265 | 0.240 | 0.165 | 0.204 | 0.338 | 0.279 | 0.261 | 0.377 | 0.104 | 0.209 | -0.125 |
| 69 | 0.197 | 0.106 | 0.195 | 0.243 | 0.160 | 0.220 | 0.015 | 0.093 | 0.076 | 0.031 | 0.102 | -0.016 | 0.096 |
| 70 | 0.133 | 0.060 | 0.165 | 0.212 | 0.108 | 0.107 | 0.211 | 0.214 | 0.111 | 0.220 | 0.060 | 0.074 | -0.029 |
| 71 | 0.317 | 0.491 | 0.482 | 0.379 | 0.332 | 0.453 | 0.410 | 0.356 | 0.439 | 0.452 | 0.053 | -0.097 | 0.112 |
| 72 | 0.329 | 0.161 | 0.438 | 0.474 | 0.445 | 0.379 | 0.216 | 0.154 | 0.315 | 0.291 | 0.145 | 0.091 | 0.026 |
| 73 | 0.457 | 0.364 | 0.591 | 0.498 | 0.442 | 0.558 | 0.412 | 0.284 | 0.416 | 0.376 | 0.109 | 0.004 | 0.038 |

TABLE 3 Continued

| Correlation Coefficients | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 1.000 | | | | | | | | | | | | |
| 28 | 0.175 | 1.000 | | | | | | | | | | | |
| 29 | 0.547 | -0.695 | 1.000 | | | | | | | | | | |
| 30 | 0.189 | -0.087 | 0.196 | 1.000 | | | | | | | | | |
| 31 | 0.130 | -0.109 | 0.178 | 0.720 | 1.000 | | | | | | | | |
| 32 | 0.227 | 0.003 | 0.141 | 0.624 | 0.656 | 1.000 | | | | | | | |
| 33 | 0.257 | 0.033 | 0.147 | 0.617 | 0.659 | 0.643 | 1.000 | | | | | | |
| 34 | 0.060 | -0.004 | 0.025 | 0.047 | 0.075 | 0.102 | 0.121 | 1.000 | | | | | |
| 35 | -0.113 | -0.046 | -0.058 | -0.228 | -0.257 | -0.264 | -0.181 | -0.247 | 1.000 | | | | |
| 36 | -0.016 | -0.079 | 0.024 | 0.369 | 0.295 | 0.202 | 0.202 | 0.088 | -0.083 | 1.000 | | | |
| 37 | 0.016 | -0.015 | 0.020 | 0.353 | 0.367 | 0.258 | 0.344 | 0.067 | -0.164 | 0.525 | 1.000 | | |
| 38 | -0.008 | 0.013 | -0.031 | 0.037 | -0.053 | -0.095 | -0.078 | 0.165 | 0.019 | 0.138 | 0.013 | 1.000 | |
| 39 | 0.014 | 0.048 | -0.021 | 0.168 | 0.231 | 0.237 | 0.226 | 0.027 | -0.117 | 0.020 | 0.196 | 0.002 | 1.000 |
| 40 | 0.027 | 0.014 | -0.012 | 0.043 | 0.065 | 0.082 | 0.210 | 0.048 | 0.050 | -0.133 | -0.018 | -0.154 | -0.062 |
| 41 | -0.001 | -0.059 | 0.046 | -0.070 | 0.007 | 0.081 | 0.053 | -0.029 | 0.010 | 0.027 | 0.151 | -0.142 | -0.093 |
| 42 | 0.055 | -0.028 | 0.077 | -0.106 | -0.133 | -0.172 | -0.125 | -0.113 | 0.002 | -0.070 | -0.125 | -0.566 | -0.510 |
| 43 | -0.020 | -0.141 | 0.118 | 0.114 | 0.117 | -0.002 | 0.102 | 0.007 | -0.120 | 0.137 | -0.003 | -0.397 | -0.271 |
| 44 | 0.082 | 0.068 | 0.009 | 0.073 | 0.119 | 0.120 | -0.006 | -0.091 | -0.097 | -0.131 | 0.022 | -0.138 | -0.052 |
| 45 | 0.055 | 0.098 | -0.045 | -0.284 | -0.338 | -0.250 | -0.261 | -0.106 | 0.176 | -0.186 | -0.154 | -0.169 | -0.280 |
| 46 | 0.002 | -0.007 | -0.017 | -0.001 | -0.045 | 0.016 | -0.026 | 0.068 | -0.051 | -0.018 | 0.063 | 0.339 | 0.228 |
| 47 | -0.069 | -0.007 | -0.042 | 0.001 | -0.040 | -0.048 | -0.023 | 0.146 | -0.041 | 0.111 | -0.016 | 0.716 | 0.069 |
| 48 | -0.140 | -0.026 | -0.070 | -0.004 | 0.137 | 0.053 | -0.006 | -0.146 | 0.030 | 0.010 | 0.075 | 0.091 | 0.394 |
| 49 | 0.014 | 0.014 | -0.015 | 0.129 | 0.158 | 0.150 | 0.210 | 0.053 | -0.027 | -0.021 | 0.043 | -0.057 | 0.080 |
| 50 | 0.022 | -0.029 | 0.029 | -0.094 | -0.031 | -0.063 | -0.037 | 0.010 | -0.030 | 0.029 | 0.165 | -0.053 | -0.076 |
| 51 | 0.007 | -0.052 | 0.022 | 0.190 | 0.241 | 0.179 | 0.212 | 0.061 | -0.079 | 0.053 | 0.069 | 0.085 | 0.190 |
| 52 | -0.081 | 0.051 | -0.090 | -0.014 | 0.002 | 0.056 | -0.000 | 0.081 | 0.075 | 0.061 | 0.034 | 0.609 | 0.456 |
| 53 | 0.184 | 0.057 | 0.096 | 0.113 | 0.162 | 0.117 | 0.196 | 0.067 | -0.061 | 0.037 | 0.092 | 0.020 | 0.204 |
| 54 | -0.041 | -0.027 | -0.021 | -0.066 | -0.004 | -0.076 | 0.034 | 0.099 | 0.037 | -0.109 | 0.000 | -0.038 | 0.133 |
| 55 | 0.080 | 0.085 | -0.026 | -0.021 | -0.002 | -0.039 | 0.093 | -0.040 | 0.067 | -0.109 | -0.020 | 0.054 | 0.075 |
| 56 | -0.027 | -0.004 | -0.039 | 0.134 | 0.116 | 0.118 | -0.041 | -0.038 | -0.007 | 0.110 | 0.068 | 0.088 | 0.020 |
| 57 | 0.037 | -0.048 | 0.062 | 0.128 | 0.081 | 0.020 | -0.075 | -0.043 | 0.054 | 0.010 | 0.049 | 0.123 | 0.072 |
| 58 | 0.039 | 0.006 | 0.044 | 0.342 | 0.188 | 0.204 | 0.212 | 0.127 | -0.073 | 0.213 | 0.265 | 0.082 | 0.145 |
| 59 | 0.162 | 0.112 | 0.077 | 0.113 | 0.016 | 0.015 | 0.110 | 0.127 | -0.106 | 0.058 | 0.001 | 0.004 | -0.027 |
| 60 | 0.142 | 0.195 | -0.091 | 0.387 | 0.264 | 0.243 | 0.345 | 0.116 | -0.040 | 0.255 | 0.269 | 0.069 | 0.196 |
| 61 | 0.118 | 0.032 | 0.076 | 0.203 | 0.146 | 0.088 | 0.155 | -0.051 | -0.066 | 0.092 | 0.137 | 0.049 | 0.162 |
| 62 | 0.049 | 0.057 | -0.016 | -0.015 | -0.075 | -0.039 | 0.006 | 0.022 | -0.035 | 0.007 | 0.017 | -0.091 | 0.073 |

TABLE 3 Continued

| Correlation Coefficients | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 0.003 | 0.077 | -0.088 | 0.182 | 0.079 | 0.135 | 0.038 | -0.074 | 0.055 | 0.060 | -0.047 | -0.129 | -0.057 |
| 64 | 0.032 | 0.035 | 0.012 | 0.151 | 0.061 | 0.088 | 0.122 | 0.034 | 0.071 | 0.137 | 0.033 | -0.085 | 0.063 |
| 65 | 0.052 | 0.008 | 0.025 | 0.092 | 0.046 | 0.034 | 0.096 | -0.007 | -0.099 | 0.014 | 0.053 | -0.005 | 0.043 |
| 66 | 0.062 | 0.076 | 0.014 | 0.131 | 0.112 | 0.073 | 0.151 | -0.075 | -0.008 | -0.000 | 0.020 | 0.169 | 0.240 |
| 67 | 0.038 | 0.069 | -0.042 | 0.164 | 0.056 | 0.097 | 0.088 | -0.026 | 0.005 | 0.075 | 0.006 | -0.120 | 0.022 |
| 68 | 0.155 | 0.176 | -0.028 | 0.408 | 0.244 | 0.231 | 0.332 | 0.157 | -0.096 | 0.257 | 0.268 | 0.068 | 0.171 |
| 69 | 0.120 | 0.049 | 0.071 | 0.210 | 0.148 | 0.101 | 0.179 | -0.073 | -0.020 | 0.068 | 0.094 | 0.143 | 0.226 |
| 70 | 0.136 | 0.144 | -0.018 | 0.363 | 0.200 | 0.203 | 0.273 | 0.046 | -0.053 | 0.194 | 0.169 | 0.008 | 0.165 |
| 71 | 0.207 | -0.036 | 0.161 | 0.352 | 0.271 | 0.469 | 0.399 | 0.090 | -0.047 | 0.129 | 0.172 | 0.013 | 0.118 |
| 72 | 0.012 | 0.053 | -0.025 | 0.038 | 0.028 | 0.010 | 0.240 | 0.171 | 0.036 | -0.016 | 0.101 | 0.036 | 0.222 |
| 73 | 0.078 | 0.065 | 0.002 | 0.301 | 0.231 | 0.224 | 0.389 | 0.145 | -0.155 | 0.141 | 0.230 | -0.064 | 0.099 |

## TABLE 3 Continued

| Correlation Coefficients | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | 1.000 | | | | | | | | | | | | |
| 41 | 0.131 | 1.000 | | | | | | | | | | | |
| 42 | -0.322 | -0.112 | 1.000 | | | | | | | | | | |
| 43 | -0.165 | -0.031 | 0.600 | 1.000 | | | | | | | | | |
| 44 | 0.112 | 0.049 | 0.090 | -0.170 | 1.000 | | | | | | | | |
| 45 | -0.242 | -0.118 | 0.467 | -0.347 | -0.105 | 1.000 | | | | | | | |
| 46 | 0.111 | 0.417 | -0.492 | -0.321 | 0.038 | -0.239 | 1.000 | | | | | | |
| 47 | -0.081 | -0.154 | -0.497 | -0.405 | -0.136 | -0.080 | 0.097 | 1.000 | | | | | |
| 48 | -0.210 | -0.011 | -0.384 | -0.189 | -0.060 | -0.219 | -0.034 | -0.019 | 1.000 | | | | |
| 49 | 0.804 | 0.081 | -0.453 | -0.234 | 0.045 | -0.292 | 0.056 | 0.002 | -0.183 | 1.000 | | | |
| 50 | 0.089 | 0.705 | -0.095 | -0.077 | 0.119 | -0.074 | 0.491 | -0.232 | 0.026 | 0.032 | 1.000 | | |
| 51 | 0.666 | 0.107 | -0.541 | -0.278 | 0.055 | -0.352 | 0.215 | 0.028 | -0.067 | 0.832 | 0.026 | 1.000 | |
| 52 | -0.152 | -0.127 | -0.735 | -0.489 | -0.161 | -0.258 | 0.280 | 0.634 | 0.548 | -0.120 | -0.186 | -0.054 | 1.000 |
| 53 | -0.149 | -0.116 | -0.014 | -0.072 | 0.046 | 0.046 | -0.038 | -0.034 | 0.034 | -0.041 | -0.064 | -0.048 | 0.058 |
| 54 | 0.147 | 0.062 | -0.073 | -0.005 | 0.029 | -0.093 | 0.085 | -0.019 | -0.069 | 0.141 | 0.051 | -0.070 | 0.069 |
| 55 | 0.089 | 0.044 | 0.007 | -0.023 | 0.038 | 0.019 | 0.056 | -0.030 | -0.024 | 0.052 | -0.010 | 0.179 | -0.034 |
| 56 | -0.175 | -0.121 | -0.077 | -0.005 | -0.112 | 0.040 | -0.022 | -0.036 | 0.275 | -0.132 | 0.003 | -0.088 | 0.103 |
| 57 | -0.107 | -0.025 | -0.109 | -0.035 | -0.050 | -0.069 | 0.058 | 0.012 | 0.153 | -0.013 | -0.008 | 0.040 | 0.116 |
| 58 | -0.031 | -0.012 | -0.069 | -0.022 | 0.042 | -0.074 | 0.033 | 0.066 | -0.003 | 0.018 | -0.035 | 0.038 | 0.068 |
| 59 | -0.060 | 0.076 | 0.071 | 0.044 | 0.210 | -0.051 | 0.010 | -0.040 | -0.100 | -0.067 | 0.037 | 0.011 | -0.043 |
| 60 | 0.116 | 0.058 | -0.173 | -0.083 | 0.078 | -0.144 | 0.149 | 0.060 | -0.034 | 0.130 | 0.057 | 0.080 | 0.097 |
| 61 | -0.055 | -0.115 | -0.079 | -0.076 | 0.017 | -0.015 | 0.004 | 0.060 | 0.184 | -0.027 | -0.145 | 0.057 | 0.144 |
| 62 | -0.044 | 0.027 | 0.054 | -0.000 | 0.165 | -0.002 | 0.067 | -0.032 | 0.109 | -0.084 | 0.031 | -0.065 | -0.005 |
| 63 | 0.010 | 0.009 | 0.098 | -0.013 | 0.012 | 0.127 | -0.030 | -0.039 | 0.008 | 0.010 | -0.005 | -0.025 | -0.071 |
| 64 | 0.015 | 0.046 | 0.057 | 0.013 | -0.020 | 0.061 | -0.019 | -0.021 | 0.017 | -0.010 | 0.038 | -0.077 | -0.012 |
| 65 | 0.113 | 0.010 | -0.060 | -0.030 | 0.093 | -0.075 | 0.079 | -0.034 | 0.016 | 0.082 | 0.012 | 0.133 | -0.014 |
| 66 | -0.105 | -0.159 | -0.180 | -0.131 | -0.034 | -0.053 | 0.048 | 0.186 | 0.135 | -0.042 | -0.212 | 0.074 | 0.279 |
| 67 | 0.036 | 0.027 | 0.065 | -0.012 | 0.077 | 0.059 | 0.022 | -0.058 | 0.041 | 0.007 | 0.019 | -0.007 | -0.049 |
| 68 | 0.050 | 0.052 | -0.107 | -0.043 | 0.150 | -0.139 | 0.114 | 0.041 | -0.063 | 0.069 | 0.032 | 0.075 | 0.061 |
| 69 | -0.097 | -0.150 | -0.163 | -0.124 | -0.043 | -0.036 | 0.023 | 0.157 | 0.189 | -0.036 | -0.196 | 0.064 | 0.262 |
| 70 | 0.018 | -0.001 | -0.065 | -0.065 | 0.109 | -0.049 | 0.078 | 0.039 | 0.045 | 0.029 | -0.029 | 0.053 | 0.079 |
| 71 | 0.011 | -0.090 | -0.083 | 0.024 | -0.040 | 0.040 | -0.109 | -0.054 | -0.008 | 0.047 | -0.175 | 0.055 | 0.057 |
| 72 | 0.125 | -0.122 | -0.120 | -0.076 | -0.068 | -0.029 | 0.109 | 0.085 | -0.080 | 0.093 | -0.130 | 0.075 | 0.122 |
| 73 | 0.049 | -0.181 | 0.053 | 0.063 | 0.086 | -0.043 | -0.076 | -0.021 | -0.142 | -0.110 | -0.173 | 0.096 | -0.128 |

TABLE 3 Continued

| Correlation Coefficients | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | 1.000 | | | | | | | | | | | | |
| 54 | -0.226 | 1.000 | | | | | | | | | | | |
| 55 | -0.151 | 0.537 | 1.000 | | | | | | | | | | |
| 56 | 0.096 | -0.343 | -0.232 | 1.000 | | | | | | | | | |
| 57 | -0.180 | 0.332 | 0.350 | 0.088 | 1.000 | | | | | | | | |
| 58 | 0.120 | 0.110 | 0.087 | 0.120 | 0.045 | 1.000 | | | | | | | |
| 59 | 0.039 | 0.029 | 0.100 | -0.000 | -0.050 | 0.421 | 1.000 | | | | | | |
| 60 | 0.038 | 0.050 | 0.031 | 0.053 | 0.047 | 0.361 | 0.212 | 1.000 | | | | | |
| 61 | 0.273 | -0.105 | 0.017 | 0.081 | -0.065 | 0.289 | 0.043 | 0.139 | 1.000 | | | | |
| 62 | 0.105 | 0.126 | -0.028 | -0.093 | 0.007 | 0.194 | 0.141 | 0.227 | 0.202 | 1.000 | | | |
| 63 | -0.082 | 0.045 | -0.028 | 0.112 | 0.095 | 0.093 | 0.086 | 0.372 | -0.038 | 0.298 | 1.000 | | |
| 64 | -0.106 | -0.044 | -0.059 | 0.007 | -0.032 | 0.114 | 0.118 | 0.358 | 0.089 | 0.316 | 0.540 | 1.000 | |
| 65 | -0.048 | 0.129 | 0.096 | -0.007 | -0.000 | 0.195 | 0.388 | 0.377 | 0.084 | 0.262 | 0.317 | 0.162 | 1.000 |
| 66 | 0.194 | 0.046 | 0.015 | -0.089 | -0.003 | 0.157 | 0.109 | -0.053 | 0.539 | 0.199 | -0.097 | 0.016 | -0.035 |
| 67 | -0.037 | 0.086 | -0.006 | 0.032 | 0.040 | 0.192 | 0.241 | 0.476 | 0.089 | 0.586 | 0.858 | 0.705 | 0.667 |
| 68 | 0.076 | 0.078 | 0.087 | 0.067 | 0.024 | 0.703 | 0.607 | 0.851 | 0.216 | 0.266 | 0.295 | 0.308 | 0.451 |
| 69 | 0.285 | -0.094 | 0.000 | 0.023 | -0.025 | 0.276 | 0.091 | 0.079 | 0.863 | 0.215 | -0.048 | 0.083 | 0.018 |
| 70 | 0.100 | 0.062 | 0.043 | 0.059 | 0.028 | 0.550 | 0.476 | 0.730 | 0.407 | 0.528 | 0.621 | 0.579 | 0.579 |
| 71 | 0.161 | -0.071 | 0.175 | 0.153 | -0.036 | 0.223 | 0.064 | 0.131 | 0.082 | -0.092 | 0.023 | -0.011 | 0.074 |
| 72 | 0.083 | 0.191 | 0.262 | -0.237 | -0.167 | 0.256 | 0.072 | 0.106 | 0.118 | 0.155 | -0.140 | -0.012 | 0.058 |
| 73 | 0.181 | 0.120 | 0.137 | -0.061 | -0.110 | 0.329 | 0.124 | 0.187 | 0.240 | 0.119 | -0.015 | 0.048 | 0.079 |

TABLE 3 Continued

| Correlation Coefficients | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 |
|---|---|---|---|---|---|---|---|---|
| 66 | 1.000 | | | | | | | |
| 67 | -0.035 | 1.000 | | | | | | |
| 68 | 0.063 | 0.457 | 1.000 | | | | | |
| 69 | 0.856 | 0.058 | 0.172 | 1.000 | | | | |
| 70 | 0.274 | 0.815 | 0.824 | 0.406 | 1.000 | | | |
| 71 | -0.048 | 0.007 | 0.177 | 0.043 | 0.108 | 1.000 | | |
| 72 | 0.207 | -0.018 | 0.181 | 0.175 | 0.133 | 0.320 | 1.000 | |
| 73 | 0.187 | 0.066 | 0.285 | 0.223 | 0.248 | 0.394 | 0.487 | 1.000 |

Total sample size = 162

Correlations above +.2 and below -.2 are significant at the .01 level

TABLE 4

MEANS, STANDARD DEVIATIONS, CORRELATIONS AND t's FOR PRE AND POST ACHIEVEMENT TESTS, 1967-1968

| Variable | Pre-test<br>Mean | S. D. | Post-test<br>Mean | S. D. | N | r | $t^a$ |
|---|---|---|---|---|---|---|---|
| STEP Writing | 289.80 | 14.91 | 298.44 | 15.21 | 162 | .576 | 7.05* |
| STEP Social Studies | 286.17 | 15.79 | 286.51 | 11.58 | 162 | .693 | .42 |
| STEP Math | 280.15 | 13.09 | 285.32 | 12.27 | 162 | .653 | 6.03* |
| STEP Science | 286.22 | 11.88 | 286.51 | 10.46 | 162 | .691 | .59 |
| COOP Reading | 156.44 | 7.39 | 159.46 | 7.14 | 162 | .799 | 12.78* |

[a] Test used was the t-model for correlated observations

*Significant beyond the 0.01 level

TABLE 5

MEANS, STANDARD DEVIATIONS, CORRELATIONS AND t's FOR PRE AND POST CREATIVITY TESTS, 1967 - 1968

| Variable | Pre-test<br>Mean | S. D. | Post-test<br>Mean | S. D. | N | r | $t^a$ |
|---|---|---|---|---|---|---|---|
| Word Association Test | 48.41 | 8.73 | 61.25 | 12.90 | 162 | .502 | 17.40* |
| Uses for Things Test | 23.18 | 8.15 | 26.99 | 11.87 | 162 | .560 | 6.90* |

[a] Test used was the t-model for correlated observations

*Significant beyond the 0.01 level

## TABLE 6

## MEANS, STANDARD DEVIATIONS, CORRELATIONS AND t's FOR PRE AND POST TESTS FOR INDEPENDENCE - BERNSTEIN Q-SORT

1967-68

| Variable | Pre-test Mean | Pre-test S. D. | Post-test Mean | Post-test S. D. | N | r | $t^a$ |
|---|---|---|---|---|---|---|---|
| Y-Sort | 77.53 | 7.26 | 80.91 | 9.32 | 162 | .368 | 6.09* |
| T-Sort | 77.92 | 8.58 | 79.67 | 10.28 | 162 | .444 | 2.81** |
| Y/T Ratio | 100.38 | 12.78 | 103.28 | 18.53 | 162 | .358 | 1.37 |

[a] Test used was the t-model for correlated observations

*Significant beyond the 0.01 level **Significant beyond the 0.05 level.

## TABLE 7

## OPTION OFFERINGS AND STUDENT CHOICE PATTERNS[a] BY SUBJECT CATEGORY

| Subject | Option Offerings N | Option Offerings % | Mean Student time By Percent |
|---|---|---|---|
| English | 71 | 20.1 | 15.6 |
| Math | 10 | 2.9 | 3.2 |
| Social Studies | 52 | 14.7 | 13.4 |
| Science | 47 | 13.1 | 11.7 |
| Counseling | 15 | 4.3 | 1.8 |
| Library Instruction | 14 | 4.0 | 6.9 |
| Study | 144 | 40.9 | 47.4 |
| TOTAL | 353 | 100.0 | 100.0 |

[a] Based on a twelve week sample of the option data in the spring of 1968

## TABLE 8

## OPTION OFFERINGS AND STUDENT CHOICE PATTERNS[a] BY TYPE OF ACTIVITY

| Activity | Option Offerings N | Option Offerings % | Mean Student time by Percent |
|---|---|---|---|
| Remedial or Review | 16 | 4.5 | 3.7 |
| Development | 110 | 31.1 | 15.1 |
| Enrichment | 73 | 20.6 | 29.5 |
| Study | 144 | 40.9 | 47.4 |
| Undifferentiated | 10 | 2.9 | 4.3 |
| | 353 | 100.0 | 100.0 |

[a] Based on a twelve week sample of the option data in the spring of 1968

## TABLE 9

## OPTION OFFERINGS AND STUDENT CHOICE PATTERNS[a] BY METHOD OF PRESENTATION

| Method | Option Offerings N | Option Offerings % | Mean Student time by Percent |
|---|---|---|---|
| Teacher-led | 52 | 14.7 | 11.4 |
| Student-led | 37 | 10.4 | 9.2 |
| Outside Speaker | 4 | 1.0 | 1.5 |
| A-V Presentation | 24 | 6.8 | 12.6 |
| Student-Teacher Conferences/Lab Open | 77 | 21.7 | 13.3 |
| Other | 15 | 4.5 | 4.6 |
| Study | 144 | 40.9 | 47.4 |
| TOTAL | 353 | 100.0 | 100.0 |

[a] Based on a twelve week sample of the option data in the spring of 1968

## TABLE 10

## CORRELATIONS BETWEEN OPTION ATTENDANCE BY SUBJECT AND ACTIVITY, 1967-68

| Subject | ACTIVITY | | |
|---|---|---|---|
| | Remedial or Review | Development | Enrichment |
| English | -.053 | .085 | .609 |
| Math | .705 | .107 | -.127 |
| Social Studies | -.076 | .190 | .456 |
| Science | .089 | .666 | -.152 |

## TABLE 11

## CORRELATIONS BETWEEN OPTION ATTENDANCE BY SUBJECT AND BY METHOD OF PRESENTATION

| Method | English | Math | Social Studies | Science |
|---|---|---|---|---|
| Teacher-led | .339 | .417 | .228 | .111 |
| Student-led | .716 | -.154 | .069 | -.081 |
| A-V Presentation | .091 | -.011 | .394 | -.210 |
| Student-Teacher Conf. or Lab Open | -.057 | .081 | .080 | .804 |

TABLE 12

SELECTED OUTCOME AND INPUT VARIABLES FOR FRESHMAN PROJECT REGRESSIONS, 1967-68

| Variable Number | Variable Name |
|---|---|
| A. Outcomes (Dependent Variables) | |
| 1 | Final Grade Averages for each discipline |
| 2 | Creativity (post-tests) |
| 3 | Bernstein Q-Sort (post Y- sort) |
| 4 | Independence Ratings by teachers for each discipline |
| 5 | Standardized STEP Achievement (post-tests) |
| B. Inputs (Independent Variables) | |
| a. Ability | |
| 1 | Latest IQ Score |
| b. Divergent Thinking | |
| 2 | Creativity |
| c. Skill Level | |
| 3 | Library Skills Test |
| 4 | Estimated Lab School Reading Level |
| 5 | Science or Social Studies Pre-tests |
| d. Achievement Level | |
| 6 | Standardized STEP Achievement |
| e. Interest Level | |
| 7 | Interest Inventory for each discipline |
| f. Personality | |
| 8 | Student Inventory Factors -- Diligence, Sociability and Individualism |
| 9 | Locus of Control -- The I/E Inventory |
| 10 | Need for Structure |
| g. Initial Independence | |
| 11 | Bernstein Q-Sort (Pre Y-Sort) |

TABLE 13

PERCENT OF VARIANCE OF FINAL GRADE ACHIEVEMENT IN EACH
ACADEMIC SUBJECT EXPLAINED BY SEVEN CATEGORIES OF INPUTS,
1967-1968

| Inputs | Final Grade Averages | | | |
|---|---|---|---|---|
| | English | Social Studies | Mathematics | Science |
| A. Ability | 1.6 | 5.8 | 6.2 | 3.5 |
| B. Creativity | 8.4 | 11.8 | 9.9 | 12.4 |
| C. Skill Level | 2.8 | 2.7 | 0.0 | 8.7 |
| D. Achievement Level | 22.3 | 11.9 | 13.1 | 7.1 |
| E. Interest Level | 0.0 | 1.3 | 0.0 | 0.1 |
| F. Personality | | | | |
| 1. Diligence | 3.7 | 1.8 | 0.9 | 6.0 |
| 2. Sociability | 0.0 | 0.0 | 0.0 | 0.0 |
| 3. Individualism | 0.3 | 0.0 | 0.4 | 0.5 |
| 4. Internal Control | 0.3 | 0.0 | 0.3 | 0.0 |
| 5. Need for Structure | 0.2 | 0.8 | 0.2 | 0.2 |
| G. Initial Independence | 1.0 | 1.0 | 0.3 | 0.1 |
| TOTAL | 40.6 | 37.1 | 31.3 | 38.6 |

## TABLE 14

### PERCENT OF VARIANCE OF TEACHER RATINGS FOR GROWTH IN INDEPENDENCE IN EACH ACADEMIC SUBJECT EXPLAINED BY SEVEN CATEGORIES OF INPUTS, 1967-1968

| Inputs | Independence Ratings by Teachers | | | |
|---|---|---|---|---|
| | English | Social Studies | Mathematics | Science |
| A. Ability | 1.3 | 4.1 | 3.6 | 4.2 |
| B. Creativity | 15.9 | 12.1 | 5.3 | 8.9 |
| C. Skill Level | 2.6 | 1.5 | 0.0 | 10.3 |
| D. Achievement Level | 11.3 | 9.6 | 0.1 | 8.1 |
| E. Interest Level | 0.0 | 0.7 | 0.2 | 0.0 |
| F. Personality | | | | |
| 1. Diligence | 6.2 | 1.1 | 2.2 | 4.3 |
| 2. Sociability | 0.0 | 0.0 | 0.0 | 0.0 |
| 3. Individualism | 0.6 | 0.1 | 0.0 | 0.1 |
| 4. Internal Control | 0.7 | 0.1 | 0.0 | 0.0 |
| 5. Need for Structure | 1.6 | 3.4 | 5.1 | 0.7 |
| G. Initial Independence | 2.1 | 2.6 | 1.5 | 1.0 |
| TOTAL | 42.3 | 35.3 | 18.0 | 37.6 |

## TABLE 15

## PERCENT OF VARIANCE IN STANDARDIZED ACHIEVEMENT TEST OUTCOMES EXPLAINED BY SIX CATEGORIES OF INPUTS, 1967-68

| Inputs | STEP Post-Tests | | | |
|---|---|---|---|---|
| | Writing | Social Studies | Mathematics | Science |
| A. Achievement Level (Pre-tests) | 33.2 | 37.2 | 18.0 | 26.1 |
| B. Ability | 0.1 | 0.7 | 1.2 | 0.6 |
| C. Creativity | 6.1 | 2.9 | 1.1 | 2.3 |
| D. Personality | | | | |
| 1. Diligence | 0.0 | 0.4 | 0.6 | 0.0 |
| 2. Individualism | 0.0 | 0.0 | 0.4 | 0.0 |
| 3. Need for Structure | 0.4 | 0.8 | 0.0 | 1.2 |
| E. Initial Independence | 0.0 | 1.6 | 2.1 | 0.6 |
| TOTAL | 39.8 | 43.6 | 23.4 | 30.8 |

TABLE 16

PERCENT OF VARIANCE IN PUPIL CREATIVITY OUTCOMES EXPLAINED BY SEVEN CATEGORIES OF FRESHMAN PROJECT INPUTS, 1967-1968

| | Post-tests for Creativity | |
|---|---|---|
| Inputs | Word Assoc. Test | Uses for Things Test |
| A. Ability | 8.3 | 0.7 |
| B. Creativity (Pre) | 23.5 | 32.4 |
| C. Skill Level (Reading) | 2.6 | 1.7 |
| D. Achievement Level (STEP Writing) | 2.3 | 5.4 |
| E. Interest Level (Interest in Art) | 0.1 | 0.1 |
| F. Personality | | |
| 1. Diligence | 0.2 | 0.4 |
| 2. Sociability | 0.0 | 0.6 |
| 3. Individualism | 0.1 | 0.2 |
| 4. Internal Control | 0.0 | 0.0 |
| 5. Need for Structure | 0.2 | 0.1 |
| G. Initial Independence | 0.0 | 0.0 |
| TOTAL | 37.3 | 41.6 |

## TABLE 17

## PERCENT OF VARIANCE IN PUPIL INDEPENDENCE OUTCOMES EXPLAINED BY SEVEN CATEGORIES OF FRESHMAN PROJECT INPUTS, 1967-1968

| | Bernstein Q-Sort Post-Tests | |
|---|---|---|
| Inputs | Post Y-Sort | Post Y/T Ratio |
| A. Ability | 0.5 | 0.0 |
| B. Creativity | 0.1 | 0.1 |
| C. Skill Level (Library Skills) | 1.7 | 1.0 |
| D. Achievement Level (STEP Writing) | 1.1 | 1.2 |
| E. Personality | | |
| 1. Diligence | 1.2 | 1.6 |
| 2. Self-confidence | 1.9 | 0.3 |
| 3. Individualism | 0.3 | 0.8 |
| 4. Internal Control | 1.3 | 0.2 |
| 5. Need for Structure | 0.3 | 0.0 |
| G. Initial Independence | 11.8 | 5.1 |
| TOTAL | 20.2 | 10.3 |

## TABLE 18

## A COMPARISON OF HIGH AND LOW "DILIGENCE" PUPILS FOR DIFFERENTIAL FRESHMAN PROJECT CHARACTERISTICS, 1967-68

(Group Means)

| Variable | Low Diligence (N=32) | High Diligence (N=28) |
|---|---|---|
| IQ | 124.9 | 129.0 |
| Estimated Reading Ability | 8.3 | 9.7 |
| STEP Writing Test | | |
| Pre-Test | 289.1 | 292.8 |
| Post-Test | 295.0 | 308.0 |
| STEP Social Studies Test | | |
| Pre-Test | 281.9 | 292.0 |
| Post-Test | 282.5 | 290.7 |
| STEP Mathematics Test | | |
| Pre-Test | 278.1 | 283.9 |
| Post-Test | 282.4 | 291.0 |
| STEP Science Test | | |
| Pre-Test | 286.2 | 291.7 |
| Post-Test | 293.0 | 289.3 |
| Final Grade Averages | | |
| English | 2.5 | 3.6 |
| Social Studies | 2.4 | 3.1 |
| Science | 2.4 | 3.4 |
| Mathematics | 2.3 | 3.1 |
| Independence Ratings | | |
| English | 5.0 | 7.5 |
| Social Studies | 4.7 | 6.4 |
| Science | 4.9 | 7.3 |
| Mathematics | 5.3 | 6.6 |
| Word Association Test | | |
| Pre-Test | 46.2 | 53.3 |
| Post-Test | 54.6 | 68.4 |
| Uses For Things Test | | |
| Pre-Test | 23.0 | 24.5 |
| Post-Test | 22.7 | 30.7 |
| Bernstein Q-Sort Instrument | | |
| Pre Y-test | 75.1 | 78.4 |
| Post Y-test | 80.5 | 85.0 |
| Need for Structure | 6.9 | 5.4 |
| Percent of Option Time in Cafeteria | 12.7 | 4.7 |

## TABLE 19

## A COMPARISON OF HIGH AND LOW "INDIVIDUALISM" PUPILS FOR DIFFERENTIAL FRESHMAN PROJECT CHARACTERISTICS, 1967-68

(Group Means)

| Variable | Low Individualism (N=43) | High Individualism (N=21) |
|---|---|---|
| IQ | 121.5 | 130.2 |
| Estimated Reading Ability | 8.4 | 9.5 |
| STEP Writing Test | | |
| Pre-Test | 287.4 | 292.4 |
| Post-Test | 295.5 | 301.0 |
| STEP Social Studies Test | | |
| Pre-Test | 278.5 | 287.3 |
| Post-Test | 283.0 | 287.6 |
| STEP Mathematics Test | | |
| Pre-Test | 276.9 | 279.4 |
| Post-Test | 283.6 | 289.6 |
| STEP Science Test | | |
| Pre-Test | 282.8 | 288.6 |
| Post-Test | 283.0 | 288.2 |
| Final Grade Averages | | |
| English | 3.2 | 3.2 |
| Social Studies | 2.7 | 2.9 |
| Science | 2.9 | 2.9 |
| Mathematics | 2.2 | 2.6 |
| Independence Ratings | | |
| English | 5.9 | 7.1 |
| Social Studies | 5.6 | 6.2 |
| Science | 5.8 | 6.7 |
| Mathematics | 5.8 | 6.5 |
| Word Association Test | | |
| Pre-Test | 48.3 | 50.7 |
| Post-Test | 59.6 | 62.8 |
| Uses For Things Test | | |
| Pre-Test | 21.1 | 25.3 |
| Post-Test | 24.7 | 27.1 |
| Bernstein Q-Sort Instrument | | |
| Pre Y-test | 78.0 | 79.7 |
| Post Y-test | 77.7 | 90.7 |
| Need for Structure | 7.0 | 5.3 |
| Percent of Option Time: | | |
| Teacher-led Activities | 10.1 | 9.1 |
| Student-led Activities | 6.1 | 8.8 |
| Enrichment Activities | 21.3 | 33.5 |